BELL TELEPHONE MAGAZINE

VOL. XXI AUGUST, 1942 NO. 3

WAR-TIME IN THE TRAFFIC DEPARTMENTS

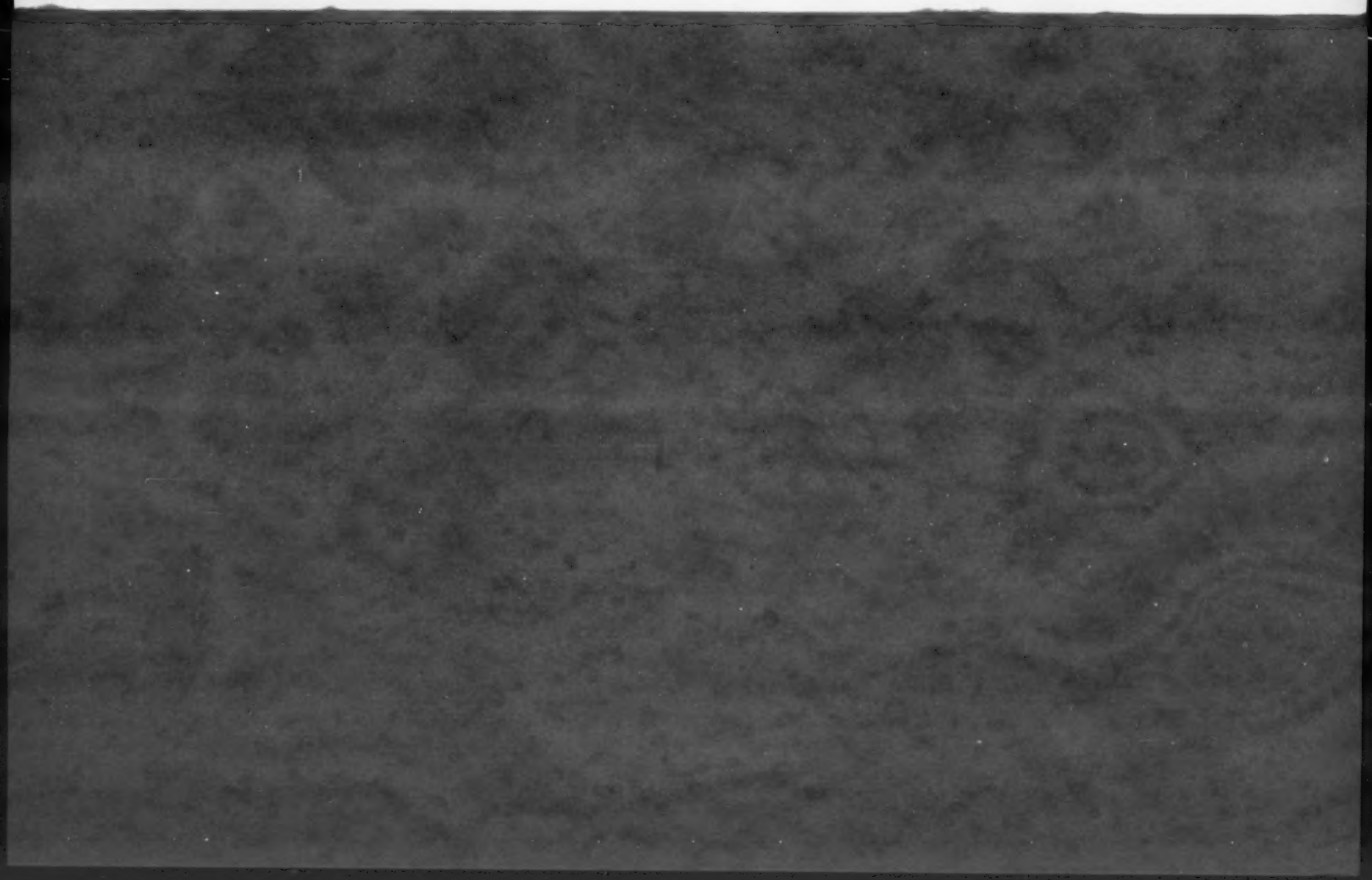
DOING A BIGGER JOB—WITH LESS

THE ORGANIZATION OF LARGE-SCALE ENGINEERING WORK

PROTECTING THE SERVICE AGAINST FIRE

TELEPHONE STATISTICS OF THE WORLD

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW YORK



BELL TELEPHONE MAGAZINE

Continuing the BELL TELEPHONE QUARTERLY

A Medium of Suggestion and a Record of Progress

"The ideal and aim of the American Telephone and Telegraph Company and its Associated Companies is a telephone service for the nation, free, so far as humanly possible, from imperfections, errors, or delays, and enabling anyone anywhere to pick up a telephone and talk to anyone else anywhere else, clearly, quickly and at a reasonable cost."

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SANDBAGGING AN INCENDIARY BOMB

This picture, taken in a Bell System building, shows a practice bomb, but illustrates the method of controlling the blaze by throwing bagged sand on and around it. *See "Protecting the Service Against Fire," page 177*

WAR-TIME IN THE TRAFFIC DEPARTMENTS

Many Problems Confront the Bell System's Operating Forces in Their Task of Furnishing a Service Which Is Essential to the Prosecution of the War and the Daily Life of the Country

By RAYMOND A. STEELMAN

BEFORE the hordes of Nazi Germany invaded Poland in September 1939, the telephone central office at Mount Holly, a quiet town in the farming section of central New Jersey, was averaging about 1,000 long distance and 3,300 local calls a day. Now, with the nation all-out to win the war, the Mount Holly exchange, which serves nearby Fort Dix, is averaging 5,800 long distance and 5,400 local calls a day, increases of 480 and 64 per cent. Then the operating force consisted of 15 people; now there are 167.

This is not an isolated case. The impact of the war has had a tremendous effect on traffic volumes, notably long distance, in many places all over the United States. While the effect has been most pronounced in the smaller offices serving military establishments and war industries, many of the larger cities are also involved. At Washington, long distance calls are up 175 per cent, Norfolk 150, St. Louis 145, Detroit 143, Louisville 110, and Baltimore 93 per cent. On the west coast, long distance traffic is up 89 per cent at San Diego, 85 at Tacoma, and 56 per cent at Seattle. For the Bell System as a whole, long distance calls are running nearly 50 per cent above the level in August 1939, while the longer-haul calls are up about 85 per cent. Calls of all types are averaging 113,000,000 a day, an increase of 29,000,000 calls!

This all adds up to a large order for the traffic departments. Just what are some of the problems the war has brought? And more important still, what is being done about them?

How the Forces Have Grown

AT the end of August, 1939, the traffic operating forces of the Bell System consisted of 114,000 people. Now, the number is 148,000. The increase in 1941 was the largest in any single year in the history of the business.

The take-off point in this matter of force is to determine exactly how many operators will be required. To the layman it has always seemed remarkable, even in normal times, that those in the traffic departments whose job it is to engineer the force can determine how many operators will be

EXPANDING TO HANDLE THE ARMY'S CALLS

The Mount Holley, N. J., central office, which serves Fort Dix, keeps on growing. The 11 switchboard positions before the war have been expanded to 74, and two additions have been made to the building

required at each hour of the day, evening, and night, on every day in the year, and in all central offices.

But these are not normal times. Traffic is not only increasing rapidly—it is increasing unevenly as between exchanges, and surges are frequent, often without warning.

Take a typical case. War maneuvers are to be held. Thousands upon thousands of troops will converge from all directions. Official Army calls, personal calls from the officers and enlisted men, calls from members of the press—all will have to be handled. How many operators will be needed? That was the problem faced in New England, in the South, on the Pacific Coast and in many other places last fall, and it will be faced again, and solved.

At Ayer, Massachusetts, for example, the operating force of 56 was expanded to 86. During the maneuvers, traffic increased almost 70 per cent in one week. Thirty operators were summoned from Lowell, Worcester, Gardiner, Athol, Pittsfield, and Springfield to help carry the load at Ayer. Other operators were brought in from distant points to swell the forces at such offices as Pepperell, Townsend, Ashby, Ashburnham, Fitchburg, Leominster and Clinton. Special arrangements to house, feed, and transport all of these operators were completed weeks before the maneuvers started.

Of course, not every future need can be forecast: sudden developments such as Pearl Harbor, the arrival of the fleet, and the canceling of leaves. To handle these sudden peaks, those on duty are requested to work overtime—and they gladly do it; or extra employees are called in under plans which have previously been prepared; or not unusually, sensing that they will be needed, they arrive before they are called. The Spirit of Service is a tradition in the traffic departments. Fire, flood, hurricane, explosion, war—there has never been a catastrophe great enough to prevent the operating forces

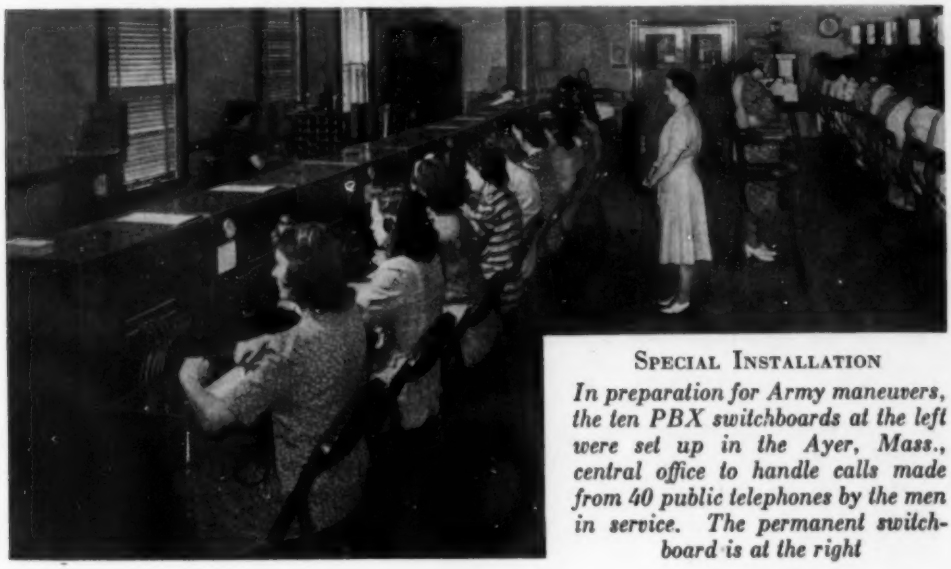
from getting to their offices when they were needed, or at least doing everything human effort and ingenuity can do to get there. In some cases, of course, margins are carried in the forces so that the impact of sudden peaks will be minimized to the greatest possible extent.

Recruiting Begins

TELEPHONE operating has long been regarded generally as a fine field for young women. The pay is good, increases are frequent, the work is interesting, working conditions are of the best. Consequently, prior to the war, most cities had large numbers of applications on file. The war changed that. Waiting lists became seriously depleted because of the large numbers of operators whom it was necessary to employ, and because of the thousands of other positions which were opening up for young women in war industries. At first only a few of the nearly 6,100 Bell System exchanges were affected, and those not to any considerable extent. Later, more and more places were involved—and to a much greater extent. Originally, most of the exchanges affected were relatively small, but by now a number of large cities have entered the picture.

Well before they were needed, plans were prepared to recruit large numbers of operators quickly, and to have them ready to operate the switchboards by the time they were required. This recruiting work is continuing, and at an accelerated pace.

In building up the forces, the cooperation of present employees is being sought. It had been the experience previously, and it still holds true, that this is one of the very best sources of obtaining good applicants. They know what it takes to be a good telephone operator. A poster such as "Girls Wanted" is one of the ways in which the employees are informed of the needs. Cards of introduction to the employment offices—which, in-



SPECIAL INSTALLATION

In preparation for Army maneuvers, the ten PBX switchboards at the left were set up in the Ayer, Mass., central office to handle calls made from 40 public telephones by the men in service. The permanent switchboard is at the right

Girls Wanted-
WILL YOU HELP SPEED THE WAR EFFORT BY RECRUITING NEW OPERATORS FROM AMONG YOUR FRIENDS?
Ask Your Chief Operator for an Introduction Card

RECRUITING POSTER

It asks present soldiers of the switchboard to enlist their friends in a vital war work

cidentally, in many cases had to be expanded substantially—have been provided for the employees to give candidates they send in for interviews. In some cases the assistance of the employees has been stimulated through pay-envelope inserts and articles in company magazines.

School authorities the country over have been most coöperative in this recruiting work. Many talks have been made before school groups by traffic representatives, company movies have been shown, recruiting leaflets have been distributed among students. These bear such titles as "Barbara Enlists in Service for Victory" and "Miss America Joins the Telephone Army."

In many places newspaper advertisements have been run, ranging from small want ads to large displays. The importance of telephone operating work in winning the war is the keynote of many, as shown by the wording of the advertisement in a Hartford newspaper that brought a fine response.

On the Move

DESPITE all such efforts, in some localities where employment conditions are most acute it has been necessary to

WANTED

Girls for work vital to the war effort with The Southern New England Telephone Company

THE ARMED FORCES, war industries, and civilian defense units keep telephone wires humming these days. To handle this flood of calls, your telephone company needs more operators — and needs them now. Here is your chance to make a real contribution to the war effort — and at the same time get a job with pleasant working conditions. You will join with an army of selected girls who have dedicated their best efforts to providing swift and accurate service in these critical times.

CAN YOU QUALIFY? To maintain the high standard of telephone service requires girls who have good eyesight, hearing, and voice. You should be right-handed, be in good physical condition and be a citizen. No previous experience is necessary.

HOW TO APPLY. If you have wondered "what you can do to help" . . . if you are interested in this opportunity for useful and agreeable work, simply **call Hartford 6-9221, Extension 210, Mrs. Moore.** She will be glad to tell you more about this interesting work and arrange an interview.

THE SOUTHERN NEW ENGLAND TELEPHONE COMPANY

NEWSPAPER ADVERTISEMENT

Many girls responded to this call in a war-busy area

import experienced operating people from places less seriously affected. Washington is an outstanding example of this, and several hundred experienced operators and supervisors have volunteered for service there. These temporarily transferred employees have come from New England and from the middle west and from points between—from Rutland, Vermont, and Boston; from Grand Forks and Fargo, North Dakota, and Enid and Oklahoma City, Oklahoma.

The spirit of those people who have packed their bags and moved to the nation's capital, and to Newport, Hartford, Norfolk, Dayton, New Orleans, Charleston, San Francisco and other places has been inspiring. They are eager to serve where they are most needed, and the satisfaction they are getting out of their work is great.

Housing—a War-time Problem

THE high reputation of the telephone companies for taking good care of their employees is of long standing. The importation of women employees into localities affected seriously by the war introduces new kinds of problems for the traffic personnel staffs. Rooms have to be found and inspected—many are obtained in the homes of company employees. Here and there company-operated dormitories have been established—some in telephone buildings, others in large houses which have been acquired for the purpose. The problem is more than one of housing. Other factors are meals, recreation, and health. All are being cared for by people who are fully aware of the needs and who are well fitted for this important work.

OFF TO WASHINGTON

Vanguard of a group of twenty Chicago employees on their way to help at the Washington switchboards

"Induction"

MOST of the young women who come to work for the telephone companies as switchboard operators are having their first experiences in the business world. They not only have to be trained for their jobs; they have to become acquainted with their new environment and their new associates, and they have to become adjusted to their hours.

Further, it is only natural for new employees to want to be well informed about the practices of the company which affect them, and for the company to want its people to be informed about these matters and about the company itself: its objectives, its poli-

Right: Bell System employees who operate the Army's private branch exchange at Camp Claiborne, La., outside the dormitory built especially for them

Left: Traffic people at cut-over of central office at Starke, Fla., which serves Camp Blanding. A company dormitory is occupied by 25 girls out of a total force of 34

OPERATORS AWAY FROM HOME

cies, and the traditions and spirit of the service. When a person accepts employment in a small store or office to work along with one or two other people, not much is involved in this matter of "induction." But when so many new telephone employees are being added in so many different places, large and small, a real problem is presented.

Comprehensive induction plans have been developed. One of the cardinal principles in these procedures is considerate treatment of the new employee as an individual, beginning not when she reports for work but in the employment office. This is one of the reasons why so many of the new employees, and the older ones too, say that they "like to work for the telephone company." There are many informal discussions with individual new employees. Sometimes small groups are assembled for this purpose. Questions from the employees are encouraged, and they are answered then and there, and fully. Other means are booklets for new employees, movies about the business, visits to other departments, etc. Throughout, the very definite plan is to give the employees information at times considered most appropriate for each of the subjects involved, and not too much at any one time.

Training

TRAINING activities include the initial training of inexperienced operators, and their subsequent training as well

Left: A new operator meets her future associates in this pleasantly furnished rest room in Charleston, W. Va. Circle: The operator's headset is the badge of her career. A new operator in Los Angeles learns from her supervisor how to adjust it

Right: In Brooklyn a new operator sits at a real switchboard, completing practice calls similar to the actual customers' calls being handled by the experienced operators beside her

FIRST DAYS ON THE NEW JOB

—which is continuous. Moreover, as the number of operators in an office increases, more supervisors are needed, and they too, have to be trained for their new and important duties.

Present-day training methods are the result of long experience and lots of study and development. The fundamental principle is to conform fully with the individual needs of each person. The soundness of these methods is attested to by the smoothness with which so many thousands of new operators have been assimilated into the forces with so little reaction on the service.

In the present situation, two broad conditions are faced in training.

First is the general increase in the sizes of the forces. This increase is being met through the extended application of established training plans and facilities.

Next are those places where the forces are growing by leaps and bounds—where war activities are multiplying training requirements manyfold.

Because new operators are trained in the operating rooms and do their practice operating under control at regular switchboard positions, a short-

LONG DISTANCE SWITCHBOARDS ARE BUSIER THAN EVER

These operators are helping to win the war at one of the four long distance switchboards in Los Angeles

age of these positions such as may accompany large increases in traffic reduces the facilities available for training. Where the problem is acute, special expedients are employed. These relief measures include the utilization of additional practice facilities, and training not only during evening and night hours but on Sundays and holidays as well; in some cases practically around the clock, seven days a week.

While geared up to meet wartime volumes, basic standards are being maintained. Each student continues to receive training which in all its essentials, including practice operating, is meeting the high objectives established long before the war.

Switchboards

SWITCHBOARDS and their associated facilities are the matériel of the operators on the communications front.

It is the job of the traffic engineering groups to collect, summarize, and interpret cold statistical data and finally to convert them into what will be living switchboards. The war has created unprecedented amounts of this work. Five thousand is a conservative estimate of the number of traffic orders for facilities related to the war which have been turned out during the past twelve months. Almost 1,500 of these were of a major type related directly to long distance and local central offices serving Army camps, naval bases, air fields, ordnance plants and other military establishments.

Almost every type of switchboard and facilities associated therewith has been covered. The equipment specified ranged from minor additions to entirely new and complete central offices the principal purpose of which is to serve a war establishment, such as the new office at Cataumet, Massachusetts, that serves Camp Edwards and the new office at Starke, Florida, that

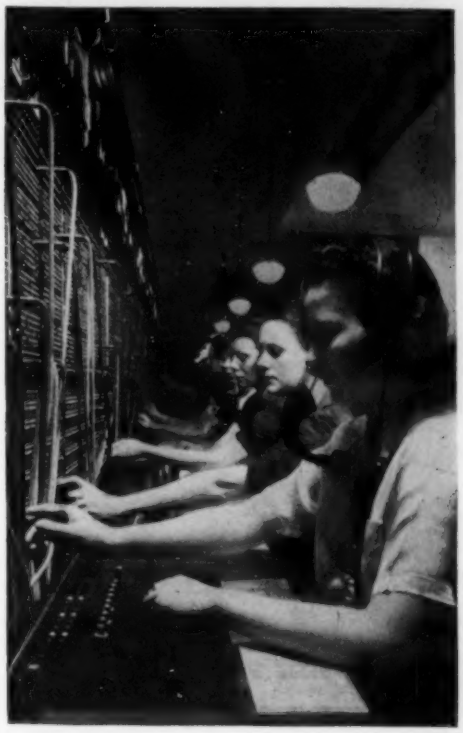
CENTRAL OFFICE ON WHEELS

This mobile central office has positions for five operators, and storage batteries and charging equipment, all mounted on a trailer. Always available for an emergency, it is an unusual feature of telephone plant in Southern California

serves Camp Blanding. In these and many other cases, due to a lack of basic data, "engineering on the cuff," backed by judgment developed from long experience, was the order of the day.

Speed has been an important factor in all of this work. A traffic engineer usually waits one, two, or even three years to see his mental efforts transformed into working equipment. But in time of war new switchboards spring into being, and others sometimes double or triple in size, in three to six months from the time they were first conceived.

The problem has been more than one of speedily engineering new boards and expansions that involved the use of standard facilities. Ingenuity of a high order has been called for in adapting available equipment to purposes for which it was not primarily intended. Means of speedily providing temporary facilities to meet the large increase in long-distance traffic include the use of local manual positions, dial service positions, and public telephone positions for handling outward long distance traffic, and arrangements for transferring



THE MESSAGE MUST GO THROUGH

This slogan is the living creed of these Long Lines operators in New York, as it is of all telephone employees

IT'S V FOR VICTORY NOW—
not "V for Victor," in the phrasing of this Chicago information operator

traffic to other long-distance centers where spare facilities may be available at certain times. Such expedients have required changes in operating methods and practices, or the use of varying practices within the same office and by the same operators.

Circuits

IT is the practice of the traffic departments to make comprehensive studies of the flow of traffic over the vast network of intercity circuits. From these studies of the number of calls, their distribution, their characteristics, and the rates of growth, circuit layouts are planned. These basic layouts are of course changed from time to time as the needs arise. Many months ago, in anticipation of more rapid growth in long distance calls, plans for a substantial increase in facilities were made. In addition, as great numbers of people moved from old localities to new in connection with industrial and military expansions, many more rearrangements than normally have been required.

Circuit layouts also have to be changed to care for temporary peaks. Some of these are known about in advance, such as a large convention coming to town, and holidays when long distance service is extensively used—Christmas, Mother's Day, Easter, and even Father's Day.

Other peaks about which there is some information in advance are the evening and week-end peaks in camp areas. Petersburg, Virginia, is an example. The Petersburg exchange serves Camp Lee. In the daytime there are normally four direct circuits to New York; in the evenings, when the men call home, these are stepped up to 20. There is one direct circuit to Pittsburgh in the daytime; in the evenings there are five. There are no direct circuits to Chicago or Philadelphia in the daytime; in the evenings there are three and four respectively.

The war has greatly increased the problem of unpredictable surges in long distance traffic. Here again, camp traffic provides a good example. When a large body of troops moves from a camp and others move in, who can name in advance, and come close to being right, the places these men will want to call and the number of calls they will wish to place to each location? Tonight most of the traffic from a certain camp's long distance center may be flowing north. To-

NEW SINCE PEARL HARBOR

This traffic control bureau in San Francisco functions as one of the "watch towers" for the Bell System's network of long distance telephone lines throughout the United States. Right: Colored plugs indicate line and circuit conditions

morrow night it may be flowing east or west or south.

One of the outstanding means of handling this unpredictable long distance traffic, and a means of getting the best and the most telephone service from the facilities that already exist—a most challenging problem under present conditions of very heavy traffic and shortages of material—is the traffic control bureau. Before Pearl Harbor there were three main bureaus —in New York, Cleveland, and Chicago. Since December 7, additional bureaus have been established at San Francisco and Atlanta.

These traffic control bureaus,* working together and with information obtained from other centers, have complete, up-to-the-minute knowledge of how the traffic is moving over important routes, and particularly the extent of delays actually being encountered in the various circuit groups. If the physical condition of any of the circuits is affected, as in the case of a storm, they know about that too. Delegated with authority to make de-

* For an account of the work of the traffic control bureaus, see "On Watch—All Over the Map," BELL TELEPHONE QUARTERLY, April, 1939.

IN BUSY WASHINGTON

This is the call-distributing information and intercepting desk of one of the world's largest dial private branch exchanges

cisions and to take immediate action, they re-allocate circuits on the basis of relative needs at different places, taking into account the total picture.

The aim is to preserve the best possible balance throughout, to the end that as many as possible of the thousands and thousands of people all over the country who want to talk to a distant point will be able to talk from the places they happen to be in, to the places they wish to talk to, at the times they wish to talk, and with a minimum of delay. During a recent five-day period, the Long Lines Department of the American Telephone and Telegraph Company alone made a total of over 3,500 circuit rearrangements.

Private Branch Exchanges

RAPID and unprecedented industrial and military expansion has brought with it the need for many new and many enlarged private branch exchanges in Government bureaus and departments, war plants, and military establishments in every section of the United States.

The traffic departments start on these projects by working with the other departments of the telephone company and with the customer in engineering the type and size of the system to be installed. Frequently, unusual problems associated with the war are presented; for example, a special type of switchboard for emergency operating.

Before the war, a company now having large war orders had a one-position manual private branch exchange. Now its telephone system, which serves employees located in 12 scattered buildings, consists of four

dial private branch exchanges having a total of 17 switchboard positions. There are 1,500 extension lines, 130 central office trunks, and 64 tie lines. An interesting feature of this system is its flexibility. Extension users can dial from one branch to another branch in the system by code dialing through apparatus located in the main office. This particular feature called for special attention by the traffic department in the preparation of information for the customers' various directories, and the giving of verbal instructions to extension users.

There are 52 operators, 90 per cent of whom were obtained by the telephone company. The operators were trained on dial work in the telephone company's private branch exchange school. A complete training course was given the chief operator, who formerly was an operator at her employer's one-position board.

The telephone company has assigned private branch exchange instructors to supervise operations and collaborate with the customer's representatives on daily peg counts, force adjustment layouts, special operating features, and house directory listings.

This is a typical case, cited to portray expansions in this field and ways in which the traffic departments are working with large users of telephone service the country over. Some of the private branch exchanges are, of course, larger than the one described. A few are much larger. A private branch exchange now being installed for one of the large departments of the Government will have 125 switchboard positions and 13,000 lines initially, bigger by far than any other private branch exchange, even bigger than any single local central office in the entire Bell System!

Teletypewriter Service

THE use of teletypewriter service by industry, military establishments, Government bureaus, and civilian de-

TELETYPEWRITER TRAINING

These Navy men are receiving instruction in "TWX" operation at the Illinois Bell Telephone Company's school in Chicago

"ALL CLEAR"

A traffic supervisor sends that signal to every telephone building in Dallas. The other three buttons at her fingertips give various air-raid signals

fense units has increased greatly because of the war. Here again, the traffic departments are active in training customers' attendants to operate the machines. This training is given either on the customers' premises or in telephone company schools.

Army Private Branch Exchanges

THE Bell System, in its full cooperation with the Signal Corps of the United States Army, has been requested since Pearl Harbor to take over the operation of the private branch exchanges at many Army posts throughout the country—supply depots, air fields, forts, camps and hospitals.

In quite a few cases this form of operation has introduced problems much the same as those previously described in connection with employees who volunteer for other work away from home, and including housing the operating forces inside the camps. While the service which has to be rendered at an Army switchboard is different in some respects from the handling of regular commercial calls in a telephone company central office, it is work which any experienced operator can learn with ease, and they like it. The Bell System now has over 800 operating employees at these establishments, and the number is increasing almost daily.

Pleasing Service for Service Men

MORE and more men are pouring into Army reception centers, training camps, flying schools, naval stations, and air bases that are getting bigger and bigger and bigger. That means that more soldiers and more sailors and more marines are making more telephone calls. One million men, two million men, three million men . . . millions of men wanting from time to time to call mothers, wives, friends, and sweethearts by telephone. A lot has been done to make this service adequate and satisfactory: new central office buildings and enlarged central office buildings in camp sections, more circuits, more public telephones. And better still, more will be done to make this service more convenient, more pleasing, more thoughtful, more personal.

Attended public telephone service is already provided at many military establishments and in nearby communities where service men congregate. Under this form of service the person wishing to make a call gives the details to one of the traffic employees on the spot. She takes the call, records it, passes it to the central office or handles the call herself, and notifies the man when the connection is made. At the larger places several girls are in attendance. If there will be a delay, the attendant personally explains the

situation to the man. In many cases comfortable chairs or benches are provided. If he wishes, he can go away and come back later at about the time completion is due. It is not necessary for him to have the correct change—he pays the attendant for the call.

Attended public telephone service is telephone service personalized to the greatest possible extent, and the most efficient use of the trunks and other facilities necessary to complete calls is ensured. It is particularly helpful in peak hours. The soldiers like this form of service, and it is being extended.

Serving for Victory

IN the traffic departments of the Bell Telephone Companies there are *148,000 soldiers of service*—all, truly, *serving for victory*. They wear no uniforms. But they're in the thick of war activity just the same.

That the Army recognizes this is plain when it says, "Every day millions of telephone calls help the Army to push forward on its all-important job. The telephone speeds production of planes and tanks and guns. Telephone messages direct the rapid movement of troops and equipment. Warnings of possible enemy air attack are flashed over telephone lines. On a war front stretching around the world, telephone and radio-telephone give instant communication. America's telephone system serves all industry that serves the Army, and it serves the Army all the time."

SERVICE FOR THE MEN IN CAMP

These attended public telephones are in a separate building at a West Coast air base. The directories are also handy for looking up the addresses of folks back home

WE TOO..CAN DO OUR PART
FOR NATIONAL DEFENSE
accurate - speedy - helpful service
TELEPHONE SERVICE IS A VITAL LINK TO ARMED SERVICES, INDUSTRY
AND CIVILIAN EFFORT IN MAKING OUR COUNTRY STRONG

REMINDERS

Even when the goal was "national defense," such posters as that above reminded the traffic forces in Oregon that they have an important part to play. On the opposite page is a more recent poster used in Indiana. Both are in red, white, and blue

These operating forces are in all kinds of places: large cities, medium-sized cities, small country towns. They are working at all types of switchboards and at all kinds of operating positions—local, long distance, information, intercepting, teletypewriter, and others. Collectively, they are always on the alert: a 24-hour, never-ending alert. Too much cannot be said about the fine work they are doing. And it will continue.

A great satisfaction comes from knowing that one's job is contributing to the winning of the war. No one has to tell an experienced operator how essential she is to the nation's military and industrial drive to victory. She knows. But some of the newer girls have that to learn. The use of posters is one way which has been found helpful in getting this message across. Many have been designed and executed by the employees themselves. The wordings tell the story; here are a few:

Make no mistake—telephone service is vital to winning the war, and the work of every employee is vital to the continuance of that service.

Everyone is working toward one end—Victory—*the soldier, the sailor, the marine, industry, air wardens and* you. *The service which* you *give places* you *in the front ranks.*

Some of the other wordings in this group are as follows:

In Uniform or Not: Every one of us is a partner in our country's greatest undertaking. The better we do each telephone job the better we serve the united drive which must gain victory.

Are you not proud to be in this service to our great Nation? You are in the Front Line and on the Production Line! To preserve the Cause of Hu-

man Freedom—"The Message Must Go Through." Our country is depending on you.

This is our pledge: To give the most telephone service and the best each day, to help achieve victory.

Emergency Preparations

With the nation at war, protection of its telephone service assumes greater importance than ever. Much has been done: plans for protecting the forces in case of air raids, decentralization of long distance facilities, measures to guard against sudden overloads swamping an office, measures to avoid loss of service by important military and Government establishments, the building and setting aside of emergency units of equipment ready at all times for immediate shipment and prompt installation at the scene of a major disaster.

Employee Activities

It is not only because of their work that traffic employees are so closely allied with the war effort. First Aid classes have been organized all over

A TRAFFIC CONFERENCE

These traffic supervisory people in Michigan are meeting to discuss ways to keep the quality of service at high level under the heavy demands of war-time stress

FOR THE BOYS IN SERVICE

Above: San Francisco traffic girls serving at a party planned by them for Navy men in San Francisco. Left: Needles click busily in Omaha for the Red Cross

the Bell System. In most cases the instructors are employees—people who have gone right through the regular Red Cross courses for instructors and are now teaching their associates what to do and how to do it.

Sewing and knitting for the Red Cross and the armed forces are widespread.

Many social affairs have been planned by traffic women for the men of the services—and of course they like to come. In Chicago the traffic girls presented a mobile canteen to the Salvation Army—the first of its kind in the middle west—for use in dispensing food to service men at recruiting centers and, later, for war emergency work.

During these times too much cannot be said about the tie-in between good health and the ability of the nation to produce what is needed to win. Health activities in the Bell System are of long standing. Notable in this connection is the current out-of-hour and voluntary course for Bell System women "Health, Appearance and Personality." Again, as in the case of First Aid, this course is given by employee instructors.

Service

BEFORE the war began the Bell System was furnishing this nation the best telephone service ever provided. The

Below: A class in First Aid in a Philadelphia traffic rest room

Above: A Princeton, N. J., chief operator posts the emblem which signifies that all in her office are buying war bonds

OPERATING EMPLOYEES TAKE PART IN MANY WAR-TIME ACTIVITIES

service was good technically. It was also a friendly, pleasant service—service that the customers liked and considered good. That was not enough. The aim was to make it still better. Then came the war.

Large numbers of inexperienced employees had to be hired to handle the unprecedented growth in calls, and to replace losses. Facilities became overtaxed. With these two factors working together, it was inevitable that the service would be affected somewhat.

What about the future?

Ask the operators. They are out to win. If eagerness, determination, and spirit are what it takes, then the quality of the service will be kept up.

Ask the supervisors, the chief operators, the traffic men, the executives. If skill and leadership and liking best to do the things that are the hardest to do are what it takes, then the quality of the service will be kept up.

Service is still good—surprisingly good, in the face of existing difficulties. The consensus is that it can be

FROM ONE OF THE POSTERS

"We are engaged in one of the greatest of human services, which must be continued, whatever difficulties nature of man may interpose. In times of stress its continuance often depends on the initiative and devotion of the individual employee"

maintained. In the case of long distance service, some delays are being experienced because of circuit shortages. As calls continue to increase and critical materials become scarcer and scarcer, delays may increase still more despite all the efforts which are being made and which will continue to be made, more zealously than ever before, to ensure the best possible use of all the facilities at hand. It is for this reason that advertising is directed towards the use of long distance facilities for essential calls only. The friendliness of the service has not diminished and it is not believed that it will.

No one can say how many additional employees will have to be hired. The number is sure to be large. Plans have been formulated to continue to recruit new employees so that they will be ready to operate when needed, and to shift experienced employees in still larger numbers, if necessary, to the places where they are needed most.

THE purpose of this review has been to present a brief picture of the traffic departments in time of war. The problems are many—not all can be covered. They are being approached with vigor, and they are being solved.

Traffic folks are alert. They are confident. They are looking ahead. They are working hard, and they like it. For they know that they are contributing to the winning of the war.

DOING A BIGGER JOB—WITH LESS

Western Electric's Conservation and Reclamation of Metals and Its Development of Alternative Materials Are Vital Factors in Keeping the Highways of Speech Open for War-Time Communication

By ALVIN von AUW

By broadcast and bill insert, through advertisements in magazines and newspapers, the Bell System is appealing for public coöperation in its effort to maintain an efficient telephone service at the disposal of war agencies, military and industrial. In certain abnormally war-busy areas, installation of new service or of additional equipment can be made only within definite limitations. Throughout the country, subscribers are asked to restrict their non-essential long distance calls to hours when they are least likely to clog circuits urgently needed for war business. On all calls, the public is being urged to remember that "telephone highways are overcrowded," that "war calls come first."

The long-range objective of these steps is, of course, the conservation of materials now urgently needed for war which might otherwise go into expanded telephone plant. The subscriber may rest assured, however, that this most unusual situation in which he is asked to coöperate is but one facet of an overall Bell System effort to maintain an efficient wartime communications network and, at the same time, conserve metals and materials vital to victory.

The conservation of metals and materials, although commonly regarded as an emergency measure unique to total war, is no new story to the Bell System. Principles of thrift in the use of materials have long affected the manufacturing operations of the Western Electric Company, the Bell System's organization of manufacture and supply, and the day-to-day practices of the operating companies. These principles, evolved in peacetime and put into practice as common-sense economy moves, stand the System—and the nation—in good stead today.

Down through the years Bell System engineers have been engaged in a continuing search for metals and materials which—for reasons of efficiency and economy—might replace others used in telephone manufacture. Today this same corps of engineers has mobilized its talents and experience for a wartime search for alternatives to replace materials normally used in telephone manufacture, but which the insatiable demands of the war machine have rendered scarce.

For decades one of the principal

functions of Western Electric's distributing houses has been the repair and reconditioning of used equipment for return to service. Today, with fewer and fewer *new* telephones leaving the assembly line, this activity has become more important than ever before.

Machine scrap and rejected parts from Western Electric's manufacturing operations, as well as junked telephone equipment, have long found their way, in the normal course, to reclamation furnaces to be melted down and recast as pigs and ingots of reborn metal to feed once again the assembly lines of its Hawthorne, Kearny, and Point Breeze works. War conditions have focused attention on scrap and junk as important reservoirs of essential metals, while principles of grading and segregation adopted by Western Electric many years ago as vital to successful reclamation are now being adopted throughout industry.

Supplementing these long-established metals conservation measures, the continuing researches of the Bell Telephone Laboratories through the years have turned up new telephone techniques, devised primarily in the interests of improved service, but which incidentally permit expansion of facilities with a minimum expenditure of metals—an "incidentally" that has become mighty important today. Thus, although carrier telephony was introduced into the telephone system some years ago, the Bell System's 1942 Long Lines expansion program features more prominently than ever before this technique to make less metal do more work.

In 1942 these conservation measures, for many years normal practice with the Bell System, have been geared to war conditions—all in the interests of keeping the telephone system at the highest level of efficiency consistent with the most efficient prosecution of the war effort.

Alternative Materials

To meet the equipment requirements of the nation's telephone network would normally involve vast expenditures of the very metals and materials now going into munitions manufacture. But Bell System engineers saw the pinch coming, in pre-Pearl Harbor days applied their group knowledge of the characteristics of materials to the job of finding replacements to release as much vital material as possible from telephone manufacture.

Ever since shortages first threatened, new materials have—after test and trial—been introduced into manufacturing procedure as part of a continuing, cumulative effort. And although telephone production was expected to drop this year, measures to save as much vital material as possible in the manufacture of each piece of equipment were promptly put into effect.

Alternatives introduced in the manufacture of the combined telephone set, for instance, have released hundreds of tons of essential metals and other materials for war use. Combined sets used to be made of an alloy composed of about 4 per cent aluminum, .05 per cent magnesium, and 95 + per cent zinc—all indispensable metals to a nation with a war to win. As an interim measure in the interests of saving aluminum and magnesium, the alloy's composi-

AMMUNITION FOR THE BATTLE OF PRODUCTION

Much of Nassau Smelting and Refining Company's present metals production goes into naval and ordnance production, as well as into means of communication for the Bell System

tion was changed to: 2 per cent aluminum, 1 per cent copper, .015 per cent magnesium, and the rest zinc. Meanwhile, however, production of plastic combined set housings had begun and by August, 1941, one-third of combined set production had been converted to the plastic molding process. By February of this year conversion was complete and combined set production, although running at a reduced rate, was 100 per cent plastic. Since its introduction the conversion to the plastic process has realized a saving in zinc alone of about 2,000,000 pounds.

But Western Electric's alternative materials program does not stop at the combined set's housing. It has, in fact, effected changes in the composition of scores of the more than 300 separate parts that make up the modern telephone set. Instead of aluminum, steel now goes into the dial finger wheel—saving to date: 128,000 pounds of aluminum. Steel supplants aluminum, too, in receiver and transmitter grids, while ceramic substitutes for aluminum in the transmitter barrier.

But before you begin to count the savings realized by the changes in

First Step Toward Reclamation

Reclaiming scrap metal successfully depends on careful segregation at the start. Scrap from the busy machines at Western Electric plants goes into plainly marked bins

combined-set specifications, remember that the telephone set itself represents but 10 per cent or less of the total physical plant of the telephone system and that combined set manufacture, therefore, represents but a proportionate percentage of Western Electric manufacture for the Bell System. The total savings effected by the introduction of alternatives in literally thousands of places throughout the full roster of W. E. telephone products run to really impressive totals.

Run down the roster of critical materials normally involved in telephone manufacture and you'll find that all figure in the Bell System's alternative materials program. Take copper, for instance. Copper-steel is now being used instead of bronze in drop wire, of which many millions of feet are used each year. The savings in copper effected by this change—in force since February—amount to 850,000 pounds. Another 900,000 pounds of copper have been saved by using copper-steel instead of copper for line wire.

Now look at aluminum. Upon completion of a few changes that are still in process, alternatives will have been introduced for practically all of the many telephonic uses of aluminum except in condenser foil for which, it appears, no less-scarce material can substitute satisfactorily.

Rubber stands high in the list of scarce materials essential to the war effort; stands high, too, in Western Electric's program of alternatives. Combined sets of recent manufacture, for instance, contain not a milligram of rubber. Impregnated fibre has replaced the rubber formerly used on the receiver cords, while felt pads made from reclaimed wool have supplanted rubber non-skid pads on the base of the instrument. The condenser within the set is now being wrapped with paper instead of rubber. Linoleum replaces rubber in telephone booth floor mats. "Presdwood" now goes into terminal strips, wood into telephone booth kickplates. Biggest single rubber saving of all has been effected by reducing by half the amount of "crude" in drop wire insulation—saving since the change was introduced: 185,000 pounds.

Continuing the picture of nonmetallic alternatives, cotton fabric ("leno" cloth) has replaced burlap in wrapping certain types of buried cable. Cellulose acetate rayon yarn is used instead of silk in switchboard wire.

Perhaps the most interesting of all "alternative" stories involves phenol fibre. This insulating material, used in great quantities in telephone ex-

changes, contains cresylic acid, a chemical now "drafted" for war use. In their quest for an alternative, engineers came upon a lignin resin plastic made from waste sulphite water from the manufacture of paper pulp. For years pollution of North American waterways by sulphite water had been a major problem with pulp and paper manufacturers. Today the use in telephone manufacture of the lignin resin plastic derived from this waste cuts Western Electric's use of phenol fibre by about 40 per cent.

All in all, alternatives have replaced strategic materials in more than 1,000 parts involved in telephone manufacture. When you add all these instances together, when you take into consideration, too, the necessary reduction of the Bell System's construction program, you find that the annual rate of use of aluminum has been cut by 90 per cent, crude rubber usage has decreased by 80 per cent, zinc by 75 per cent, and copper by 70 per cent. During this same interval, the Bell System's construction program has fallen off by about 25 per cent. Comparison of these statistics will readily reveal how large a share of the Bell System's materials savings can be ascribed to the program of alternatives initiated by the System's metallurgical engineers.

IN the long run, however, it's impossible to freeze the whole alternatives program in statistics—the picture changes constantly. Not infrequently, essential materials gain the "critical" status on short notice, making coördinated efforts and rapid action imperative. Often the introduction of an alternative calls for changes in design, a problem complicated by shortages of skilled toolmakers and toolmaking facilities. Then, too, there is the problem of re-substitution: alternative materials themselves have—in more than one instance—appeared on the critical list a few short months after they had been introduced into Western Electric manufacture.

To cope with multiplexities of the conservation program, the Bell System, early in 1941, set up an Intercompany Committee consisting of H. S. Osborne, A. T. & T.'s plant engineer; D. F. G. Eliot, Western Electric's general purchasing agent; R. L. Jones, director of apparatus development, Bell Telephone Laboratories; and Stanley Bracken, W. E. vice president and general manager of manufacture.

Behind this committee stands the full Bell System corps of engineers, mobilized for combined attack on the materials problem. It's the job of

INTO THE MELTING-POT

Baled nickel-silver scrap here goes into an electric induction furnace, to be re-born and prepared for re-fabrication

Bell Labs engineers to consider the technical questions involved and to pass on the suitability of the alternative materials available. Western Electric manufacturing engineers review the parts affected by the shortage in question, make an inventory of available supplies, discuss manufacturing problems with their colleagues from the Laboratories and, upon agreement, revise manufacturing information accordingly. Western Electric's purchasing department places new orders immediately, revises outstanding contracts, makes every effort to insure a smooth influx of the new material. At Western Electric works locations, engineers make prompt arrangements for the new materials to go into stock, and as swiftly adapt operations to the new manufacturing techniques required.

Reclamation

In dire need of metals for war, America today looks to her scrap heaps and junk yards as veritable "mines above ground" which, if tapped, will yield ton upon ton of metal to feed the reclamation furnaces and, in turn, our gigantic war arsenal. For many years, however, Western Electric has been tapping the huge above-the-ground mine of obsolete and worn-out telephone equipment, of machine scrap and rejected parts from its own manufacturing operations. Removed from Bell System service, obsolete and worn-out equipment is collected and sorted in Western Electric's distributing houses, and then—for the most part—goes to Western's wholly-owned subsidiary devoted to reclamation of non-ferrous metals, the Nassau Smelting and Refining Company on Staten Island, New York.

In Nassau's fiery furnaces this old equipment is melted down to yield ingots and pigs of brass, bronze, babbitt, solder and other essential metals and alloys. Much of Nassau's production returns to Western Electric to be fabricated once again into instruments of communications. Nassau solder is in almost universal use throughout the System—3,000,000 pounds of it last year—while Nassau bronze now goes into propellers for naval and merchant craft, Nassau brass into ship fittings and ordnance parts.

In an average year the Nassau Smelting and Refining Company returns to Western Electric a total of 48,000,000 pounds of reborn metal. Nassau's 1941 production, augmented by deliveries to outside customers, came to nearly twice that amount.

Nassau, too, is responsible for the disposition of much of the Bell System's scrap iron, paper, rubber, and other by-products of telephone operation. The company employs more than 400 people, including a staff of metallurgical engineers whose tests control a quality output.

Nassau is not Western Electric's only metals reclamation plant. In its own works the company maintains furnaces for the reclamation of machine scrap—the punch press skeletons, the chips from milling operations, and the other odds and ends of metal that are the inevitable by-products of metals fabrication. There's only a trickle of scrap from each machine, but multiply that trickle by the thousands of W. E. metal working operations and you get a swelling stream of essential metals.

RECONDITIONING DROP WIRE

Wire removed from service is returned to W. E. distributing houses where, as in this picture, defective sections are cut out and serviceable lengths are spliced together for re-use

But miscellaneous metals, no matter how huge the volume, are relatively worthless until they are sorted according to grade and kind. Western Electric segregates its scrap at the source—at the machine. Carefully marked bins are available for each grade and type of metal. In the metals manufacturing plant this scrap metal is re-melted, refined, re-cast, rolled and shaped into strips of metal ready for fabrication once again.

No reasonable quantity is too small to reclaim. Here's an example. The acid baths used to remove the oxide coating from newly-made copper rod removes, too, an infinitesimal amount of copper from the surface of the wire. After several runs, however, the bath grows rich in copper, copper which Western reclaims by electrolytic processes. Copper reclaimed in this fashion runs to many tons in the course of a year.

Repair and Re-use

WHAT of apparatus not obsolete but which had been removed from service because of the failure of a single part? Here again Western Electric distributing houses move to the forefront of the Bell System's war on waste. In the 29 equipment supply centers serving System operating companies, shop employees disassemble telephones and other apparatus, remove and replace ailing parts, and return the equipment to the operating companies for a new term of service.

In the field, the materials thrift habits of Western Electric and telephone company installers help to cut down

REPAIRING TELEPHONE SETS

This W. E. distributing house employee is reconditioning subscriber sets, removed from service, to help meet the growing demand for telephones in areas busy with war production

over-all Bell System use of vital materials. Although it may cost more money to take down a damaged wire, repair it, and splice it to another piece, it costs less in materials. And this is a war of materials.

Emergency Engineering

PROGRAMS for Bell System expansion have—until today—been figured in long-range terms. For instance, it seemed but common-sense economy to engineer central office construction with a view to expansion over a period of years. But war has changed all that. Perhaps it will cost more to provide switchboard additions to meet requirements of a period of only a year, but it saves copper—and saves it now. It may cost more to install a small instead of a larger cable where indications point to the necessity of installing another small one a year or so hence, but it saves metal when it's most badly needed.

New Telephone Techniques

THE habit of long-term thinking is paying dividends, none the less, in another facet of the Bell System's program to do much with little. The fundamental researches of the Bell Telephone Laboratories in the interests of an improved service have

yielded new techniques by which the System can carry a heavier load than ever before with a minimum expenditure of metals. "Carrier" telephony is one example.

"Carrier," a technique by which several conversations may be sped over the same pair of wires at the same time, has been the object of continuing development for a quarter-century, and had seen commercial use for many years before the war. Today multi-channel telephony is playing an important part in reconciling shortages of materials with an unprecedented demand for more and more long-distance voiceways.

Type "K" carrier, for instance, can carry as many as 12 conversations over two pairs of cable wires and, best of all, can frequently be installed on existing cables, multiplying their efficiency many times without significant expenditure of copper. So great, indeed, are the copper savings effected by carrier telephony that if the total carrier circuit mileage expected to be placed in operation at the end of the year were to be duplicated by ordinary open wire and cable construction, between 300,000 and 400,000 tons of additional copper would be required.

Another copper-saving product of Bell Laboratories research, the coaxial cable, can carry as many as 480 simultaneous conversations by the carrier technique. The wire-within-a-tube construction of coaxial involves far less copper than conventional cable capable of carrying a comparable load.

NONE of the Bell System's conservation measures is merely a blind substitution; all are products of coördinated organization and the "know how" of long experience. Peace-time precautions against waste are paying real dividends in war time.

By corollary, the experience gained in the test and trial of war-time operation will just as surely pay dividends in the form of improved service and economy after the war. Many of the alternative materials, having proved their efficiency and economy, are winning a permanent place in telephone manufacture. The extensive application of the standard carrier and coaxial techniques will, after the war, provide more and more voice channels to link a victorious nation together, bringing the telephone system closer to its permanent ideal of universal service, an ideal unobscured despite the restrictions of war-time operation.

THE ORGANIZATION OF LARGE-SCALE ENGINEERING WORK

Coordination of This Country's Unique and Unlimited Capacity for Productive Effort Is Engineering's Contribution to Victory over the Forces of Our Enemies

By MARK R. SULLIVAN

The text of an address delivered before the summer meeting of the American Institute of Electrical Engineers in Chicago on June 25.

THE road ahead is dim with the dust of battles still unfought but it is brighter than it would have been had our enemies not misjudged us and themselves, for when Hitler put his war on wheels he ran it straight down our alley. When he hitched his chariot to an internal combustion engine he opened up a new battle front—a front we know well."

These are General Sommervell's words. He is the head of the Service of Supply of the Army. Mass production of machines on wheels and machines that fly and the stuff that goes in them—that, he says, "is right down our alley." We can beat the enemy at that.

What that statement means to me is that "the organization of large-scale engineering work," which is the subject assigned to me today, is America's choice of a battle front. On that ground we are called to meet our enemies, and it is fortunate that this is true, for the freedom of the world depends on our acceptance of this front and our success on it.

The thing that distinguishes America on this front is its capacity for organization. The capacity to produce is not entirely a matter of raw materials and skilled labor. Other nations have as much or more of these than we have. Our ability to roll out the machines and munitions lies in soundly engineered, well trained organizations. It is a matter of organization—organization throughout, far-reaching and effective.

In more normal times, a discussion of the organization of large-scale engineering work would warrant, I think, initially defining the type and character of the particular engineering enterprise. In form and structure of organization and the procedures for its functioning, the controlling factor is the work to be done. Since the work to be done will vary greatly in different types of enterprises, the specific form and structure of the organizations would necessarily vary correspondingly. There are, however, many general functions common to all engineering enterprises. These include—

Determination of the basic requirements in accordance with the best known standards.

Preparation of specifications for technical apparatus and equipment.

Selection of the best route or location for the installation.

Obtaining and processing of the raw materials.

Employment and training of suitable construction crews.

Laying out of proper schedules for delivery of all materials to make for the most efficient and expeditious construction.

Preparation of proper operating procedures based on the engineering requirements.

Arrangements for cutting the project into service to obtain the maximum advantage of the new installation but with the minimum disruption to existing installations.

Following up the completed installation to ensure that it functions in accordance with its intended engineering design and to correct any defects in design or construction which may developed under actual operation.

To describe the organization features required for the various steps of any specific engineering project from inception to completion always makes an interesting tale. Today, however, any specific engineering enterprise, no matter how large, is dwarfed in interest and importance by the spectacular organization problem confronting the country in the conversion of our full productive capacity to wartime requirements. Under these conditions, rather than to describe the organization features of a particular engineering project, it seems to me more pertinent to treat the subject more in the abstract.

WHAT are the underlying principles of organization, recognition of which has given this nation its power and its know-how? Organization is designed to bring all available knowledge and all available energy to bear upon the specific problem at the time most needed. It presents first a problem in specialization, or division of labor, and then a problem in coördination of each of the specialties and parts of the organization so as to function as a single, unified, and cohesive team.

Long ago, Adam Smith, pointing out the great economies which are the result of specialization of labor in the production of goods and services wrote: "The greatest improvement in the productive powers of labor, and the greater part of the skill, dexterity, and judgment with which it is anywhere directed, or applied, seem to have been the effects of the division of labor."

In principle his statement is as true today as it was a century and a half or so ago when it was written. In practice specialization has been carried to an extent undreamed of then. And the more you divide the work in order to specialize on the particular parts, the more you have to coördinate in order to bring all the parts together in a whole. As degree of specialization increases to improve the productive power of labor and the necessary coordination follows, obviously the greater the supervision necessary—in other words, the more the whole enter-

prise depends on sound and able organization. There has been so much discussion of the wonderful results of science that I think the public has lost sight of the fact that science by itself does not produce the goods and services that benefit the public, that until a competent organization takes the results of scientific research and translates them into products of service with precision and economy, the public gets little good from the research.

Industrial organization for large-scale production is particularly American. Relatively to other countries, we have advanced more in organization than in science. That is why making planes and tanks is down our alley even though we had made fewer planes than others and no tanks. And the capacity for organization functions in the building of ships, guns, radars, and all the other engines and gadgets of war.

Divisions of Labor and Functions and Their Coördination

IN large scale enterprise, consideration of divisions of labor and functions and of their coördination should embrace:

Separation by broad categories such as research, engineering, manufacturing, and operations.

Specialization within each category in order that the work assigned to each individual in each part of the organization may bring to bear, recognizing the limiting capacity of the individual, the maximum dexterity, efficiency, and knowledge in handling the assigned work.

Recognition of the distinction between the respective functions of line and staff work. The line work which has to do with the actual on-the-job operations inherent in the work to be done must be supported by staff work responsible for methods, procedures and general direction of the work.

Decentralization of the work, taking into account geographical factors, to the end that the work will be performed where it can be most economically and effectively handled.

Recognition of the proper relationship of supervisory people to the total force. The importance of an adequately trained and numerically sufficient supervisory force, commonly referred to as "overhead" is worthy of emphasis. Overhead is essential because without it the result would be an untrained, undisciplined and undirected force. The exact relationship which will produce the most effective results is dependent upon the type and amount of work to be done, but even in the simplest operation some overhead is necessary. It is an established military fact, for example, that an adequately supervised army is more effective than many times its numbers of unorganized, untrained people. Hence, separate branches of the army are organized into squads, then grouped into platoons and so on until arriving finally at the collection of Army Corps, constituting the entire army. Each unit is given suitable leadership—Corporals, Sergeants, Lieutenants and on up to the Commanding General. Any other organization must follow much the same pattern.

Flowing directly from the division of labor comes the second type of problem, namely, the coördination between all units of the organization. Coördination involves:

A common objective mutually understood and subscribed to by all in the organization.

Cohesive direction accomplished by having definite lines of responsibility spreading out from the executive head of the enterprise so that each individual in the organization knows what his definite responsibilities are and to whom to turn for decisions and assistance.

Understanding on the part of each unit of the functions and responsibilities of every other unit. Such mutual understanding is, of course, essential for smooth coöperative working.

A sympathetic understanding by the personnel as a whole of the ideals and traditions of the enterprise and of the general reasons for approved procedures.

The aim of coördination is that the organization as a whole shall function as a single team; no organization can be successful unless this result is effectively achieved. This coördination, to be fully effective, must represent all work done by the various branches and individuals of the organization, usually each doing a clearly defined and component part of the whole, but all subordinating individual prominence to the efficiency of the whole.

I am but quoting the definition of teamwork. It is an intangible quality of organization; one which cannot be shown on charts; nor can any very precise formula for attaining it be stated. Above all, it should embody a spirit of service, the significance of which should instil an appreciation not only of the importance of the individual's contribution, no matter how humble the assignment, to the success of the enterprise but should also bring about a realization of the deeper meanings and values of the individual's way of life to be achieved through his part in the skilful execution of soundly conceived and well organized plans.

The Bell System Team

MANY teams are working together in this country to meet the challenge for maximum production under the impact of war. The Bell System is one such team, and I think I may say, an important team. Since I am more familiar with this organization than with others, it may prove helpful to sketch briefly the following aspects of the Bell System organization.

Since the Bell System Companies are responsible for the rendition of a large part of the telephone service to this nation, they necessarily constitute together a large and geographically extensive organization. There are about 400,000 employees, inclusive of about 10,000 engineers and scientists (the exact number being somewhat a matter of definition) located throughout the continental United States.

The nature of the enterprise embraces a very broad scope of activities related to electrical communication. These activities run all the way from the elements which enter into an electrical communication system including raw materials and ideas, go through the gamut of research, development

and design of apparatus and equipment, manufacture, fundamental engineering plans for future development, design and construction of operating plant, technical problems of maintenance and operation, and studies of technical quality of service—the final product of the organization.

An important requirement is to insure that no new device or equipment is introduced in general public usage until it has been subjected to such engineering and laboratory tests that any question as to its adaptability is resolved beyond a question of doubt. Thus it is never necessary to put into public usage untried and unproved devices, which if not suitable could have, because of the highly coördinated nature of the telephone plant, seriously adverse effects.

How the Work Is Divided

BY broad categories the work is divided as follows—

Research and development is concentrated in one large organization (Bell Telephone Laboratories, Incorporated) which carries out fundamental studies in the branches of science underlying the industry, studies new ideas which relate to telephone equipment and materials, and constantly develops new or improved apparatus and materials for use in realizing the objectives of the enterprise.

The Bell System source of supply (The Western Electric Company) is responsible for providing apparatus and materials as required, manufacturing them in accordance with Bell Laboratories specifications or arranging for their manufacture by others, making complete installations of telephone central offices or other equipment, repairing recovered apparatus, and salvaging useful materials from discontinued plant.

A centralized general staff is maintained by the American Telephone and Telegraph Company to carry out staff work of such a general nature that it is applicable to all the operating companies in variparts of the country and therefore can be done once for all. This staff work includes the investigation of new ideas, the study of service requirements, determination of field of application and programs for the introduction of new types of telephone equipment and materials, preparation of general technical information, including that required for the design, construction, maintenance and operation of the plant.

There is a series of autonomous operating companies, known as Associated Companies, each with its engineering and other operating departments and each responsible for telephone operations in a particular part of the country. There are 19 such Associated Companies, and in addition, there is the Long Lines Department of the American Telephone and Telegraph Company, which provides long distance service to tie together the long distance facilities of the System. Individual operating companies are subdivided geographically into divisions and districts in accordance with their operating requirements. The engineering work is in part concentrated in the headquarters of the com-

panies and in part distributed geographically by divisions and districts according to the nature of the work and the most effective and economical procedure for carrying out each part of the work.

Further specialization is attained within each of the broad categories:

Each company is departmentalized and the work divided within each department to meet its specialized requirements. Highly functionalized staffs are necessary and provided for. This is particularly true within the engineering and research departments, which are organized and equipped to go deep into the heart of all communication techniques. The diversity of the research work, for example, is most impressive, the research problems being scattered all along the whole frontier of the sciences, extending through the field of physical and organic chemistry, of metallurgy, of magnetism, of electric conduction, of radiation, of electronics, of acoustics, of phonetics, of optics, of mathematics, of mechanics, and even of physiology and psychology and of meteorology.

All of the work, of course, whether line or staff, engineering, research, or operations, is under the direction of competent supervision of varying grades. On the average, one out of each eight employees is a supervisory employee.

An unusually high degree of coördination is required. In handling even the simplest telephone call, for example, the procedures at the originating and terminating points, as well as in all the intermediate links, must be carried out in coördinated precision. The Bell System has been described as a team of 400,000 persons; an organization where the 400,000 can play their positions knowing all the plays and all the signals and knowing that what this team does is absolutely vital —for over its wires go many of the signals for all the other teams that are getting things done. To explore the conditions and to depict the practices, at any length, which have brought about this coördination and teamwork would require more time than can be devoted to the subject here. Suffice it to say that the high degree of coordination of the organization reflects in a great measure the ideals and traditions with which the service is endowed and the common bond between people who know the real significance of working together to serve an outstanding common purpose.

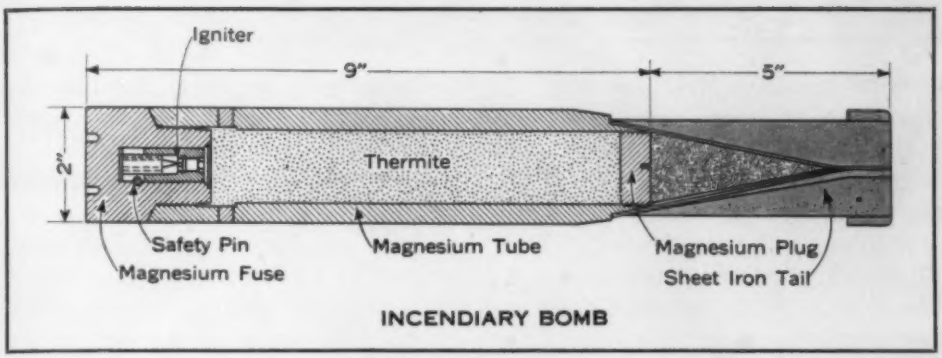
The organization features described for the Bell System are but typical of those of many other large enterprises. And of course the Bell System is only one organization, collaborating with many others, to effect maximum production for the war effort—in which effort the engineering departments have a unique responsibility.

ENGINEERING, embracing as it does the origin, cultivation, and integration of powerful forces, has a major rôle in the full, complete, and far-reaching organization of America's productive forces for total war. The military objective is not new. On the contrary, history records that engineers were first military men. In English history, for example, the word "engi-

neering" was originally applied to "the operations of those who construct engines of war and execute works intended to serve military purposes."

Now again, engineering must concentrate on military rather than civil objectives. The responsibility is grave, since the military outcome holds in its crucible the destiny of mankind. But with confidence born in the knowledge of the integrity, wisdom, and ableness of our organization leadership, we may have faith that our capacity to produce will be organized with maximum effectiveness in this our most troubled hour.

Looking beyond that, our work and spirit of today nourishes the aspiration of tomorrow—for a new world, unhampered by oppression and tyranny, a world in which the full power of organization will be utilized to produce a civilization dedicated to the well-being of mankind and bringing benefits to the individual which the boldest of men cannot now visualize.



INCENDIARY BOMB

PROTECTING THE SERVICE AGAINST FIRE

Incendiary Bombs Are Now Included in the Hazards Against Which the Bell System Takes Precautionary Measures to Safeguard Its People, Buildings, and Equipment

By IRVIN M. CUPITT

War conditions have kindled in the popular mind a new interest in what has always been a most important science: fire prevention and protection. Probably never before has public consciousness of the loss and grief caused by fire, man's best friend and also his worst enemy, reached its present high level. For fire has once again assumed proportions of a major weapon of warfare.

This is due, of course, to the bomb-carrying airplane, and brings the burden of fire defense to our own front doors. Today, civilians are called upon to a greater extent than ever before in the defense of their homes and country.

It took the grim news of the London fires to set the present generation wondering about the safety of the roofs over their heads, whereas, before, fire was something to cause a stir mostly when an alarm was sounded. It has been a long struggle, never ended, to try to make the average person "fire-prevention conscious" — to convince him it is necessary to do things and spend money to take care of conditions he hopes will never arise. But the record shows only too well the need for maintaining a day-in and day-out interest in this major problem involving a yearly U. S. fire loss of some three hundred million dollars and 10,000 lives.

The present situation, with war defense uppermost in the public mind, affords an opportunity to translate this interest into action, particularly the cultivation of personal habits of carefulness. Avoiding fire loss is, moreover, a distinct contribution to the war effort.

While the state of war now lends additional emphasis to the outstanding importance of the various phases of fire prevention, nothing has devel-

oped to change the fundamentals. It is reassuring to know that fire prevention practices developed for peacetime conditions are equally sound under conditions of war—with some precautions added for incendiary fires. Efforts expended for adequate peacetime defense in fire-resistive construction and fire-extinguishing facilities will go a long way in war-time fire defense.

Incendiary Fires

THE problem of protecting against incendiary bomb attack from the air is quite similar to normal fire protection, differing chiefly in the larger number of fires and in the peculiar action of the incendiaries. The new factors, then, for wartime conditions are the need for additional fire watchers and fighters, knowledge of incendiaries, and equipment for combating them. The burden of war-time fire fighting, therefore, falls very largely on civilians as auxiliaries to the fire departments. This is readily understandable when it is realized that the number of fires which may be produced by an incendiary attack would be many times as great as the peacetime organizations and equipment of municipal fire departments are designed to handle.

The Bell System is organized and prepared, therefore, to do its part in looking out for its own people and its own property in this as well as in the whole range of air raid precautions. This activity, broadly stated, is responsible for safeguarding telephone employees and property during an air raid. It has organized floor wardens, and patrol, fire-fighting and first-aid squads. These squads, covering various specific assignments, head up to group warden, building warden, district warden, and area warden or director—who forms the point of contact with the Civilian Defense authorities.

Each member of the organization, trained in his duties, is listed on a chart, together with his whereabouts. Periodic drills are carried out as an important part of the training course. Regular and frequent fire drills by the operating forces have been standard practice for years. Posted diagrams indicate the routes of exit to be taken by employees in case of a fire drill or actual emergency. Fire drill bells, tested daily, are a standard part of the telephone switchboard installation.

Bomb Penetration

FIRE BOMBS may use any one of several incendiary agents, with magnesium most commonly employed so far. The magnesium bomb, with its lightness of weight and intensity of heat, best fulfills the enemy objective of simultaneously starting the most fires, on account of the possible concentration of a great number of the smallest sized bombs in the limited carrying capacity of an airplane.

The magnesium bomb most generally used to date, weighing a little over two pounds, would not be able to penetrate the usual reinforced concrete or hollow tile roof on a fire-resistive telephone building. It would, however, pierce any ordinary roof of slate or tile on wood sheathing, and land on the floor below unless it should strike a beam or other roof member. In the usual case of a fire-resistive structure, the bomb would come to rest on a flat roof and burn itself out if left undisturbed. The only measurable dam-

Right: Water spray speeds combustion relatively quietly

Left: A full stream of water does a quicker but explosive job

TWO METHODS OF EXTINGUISHING MAGNESIUM BOMBS

age, it is expected, would be to the tar and gravel roofing or insulation where this type of finish is used. It is to the roofs which are not fireproof, and also to nearby buildings, that special attention would have to be directed. Skylights, which are not very common in telephone buildings, have received special consideration, in many cases being eliminated in favor of a reinforced concrete slab.

The magnesium bomb, on account of its shape and light weight, has relatively poor directional characteristics, and the bombs have a tendency to spread out as they fall. It is interesting to note that this type of bomb attains its maximum velocity after dropping a mile, beyond which its speed is uniform. Where better aim at strategic targets is an important factor, such as warehouses, docks, factories, or munitions stores, heavier bombs of equivalent construction and ranging up to more than 50 pounds in weight, are used.

What the Magnesium Bomb Is

CONSIDERABLE information has been made available on the details of the magnesium bomb used by the Nazis, but a brief look here at the chief offender might be of some interest. This 2-pound bomb, shown at the head of this article, consists of a thick-walled 80 per cent magnesium tube 9 inches long and 2 inches in diameter, filled with thermite, which is a mixture

of iron oxide and powdered aluminum. One end of the tube has a 5-inch sheet iron tail to steady the bomb in flight. The bomb operates on impact, which drives a needle into the percussion cap, which in turn ignites the thermite. The thermite, which supplies its own oxygen, burns with a somewhat violent reaction for nearly a minute and its great heat serves to ignite the magnesium. Jets of flame are emitted from vent holes designed to permit the escape of hot gases formed during this initial period, and bits of molten magnesium, which are forced through these holes, scatter in every direction for a considerable distance. The pressure in the tube diminishes with the completion of the burning of the thermite, and the bomb becomes correspondingly less active. By this time, the magnesium has been well ignited and will burn for 10 to 15 minutes if left unmolested, setting fire to any combustible material within a few feet.

For the purpose of discouraging persons from approaching the bombs, some of them are equipped with an explosive capsule on the tapered end which is covered by the tail. The explosive charge, when present, is fired by the heat from the burning magnesium in about one to two minutes after the bomb has started to burn.

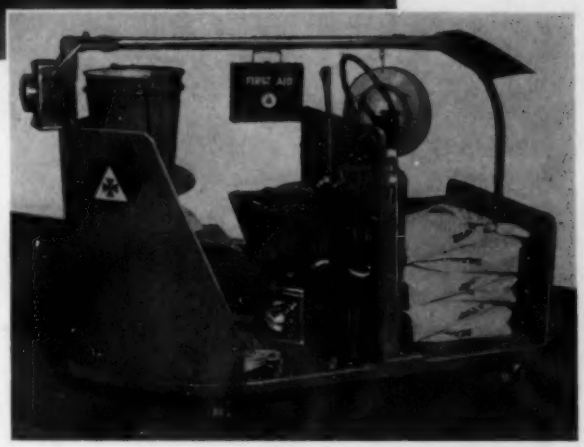
Handling the Magnesium Bomb

INCENDIARY bombs produce a very intense heat. This fact, coupled with the probability of a large number of fires being started at one time over large areas, makes it imperative to extinguish these fires promptly, not only to save individual properties but also to prevent widespread conflagrations. All possible precautions should be taken in advance to eliminate, as far as practicable, any fire hazards that needlessly exist in buildings. This will not only reduce the exposure of combustible materials to fire but will also facilitate the fighting of fires that do get started. Another important consideration is the prompt detection of the presence of a bomb after landing, and this requires close observation of the area by lookouts liberally provided for this purpose.

As soon as a bomb has landed where it can do any harm, it becomes immediately necessary to control the bomb and prevent it from burning through the roof or floor, and to localize and subdue the resulting fire before it gets out of control. At this stage, time is of paramount importance and none should be lost, especially since these sparklers may appear in a swarm.

The recommended procedures for combating incendiaries have been passing through more or less of a state of evolution since the first bombs fell from the sky over England.

Magnesium has a strong affinity for oxygen, which, in conjunction with its high combustion temperature, makes it very difficult to deal with when once ignited. Water will not extinguish burning magnesium, but it does provide a practical means of controlling the fire. When water is applied, the intense heat of the burning magnesium breaks down the water into its components of oxygen and hydrogen. The supply of these elements thus released greatly accelerates the combustion of the bomb and reduces the time of burning from 10 to 15 minutes down



TWO TYPES OF "EMERGENCY WAGONS"

These can be brought quickly to any endangered location in telephone buildings having elevators. Note the variety of bomb-fighting equipment assembled in a compact unit

to two or three minutes. This is, of course, an advantage where the surrounding fire can be restrained while the bomb is quickly being consumed. But the important thing is to have a reliable supply of water and to know how to use it.

When water is applied to the bomb as a spray, the time of burning is effectively reduced and there is a minimum of sputtering and violence. When applied as a solid stream, however, an explosive reaction takes place and white hot metal is scattered over a considerable area. During England's early experience of fighting the fire bomb, the use of a solid stream of water was considered to be the wrong procedure and was discouraged. Stirrup pumps or garden hose with dual spray and jet nozzle were accordingly recommended. The spray was used on the bomb itself, while the jet was available for dealing with any fire in the area surrounding the bomb that might require attention. This general procedure is still recommended when combustible and vulnerable equipment is exposed to the effects of a fire bomb, because of the importance of avoiding

scattering sparks and splashing of water.

IN the telephone equipment rooms and other spaces containing valuable contents subject to fire and water damage, the spray method would be followed in accordance with the practices as outlined for the Bell System.

These practices call for the use of water, applied in spray form by a stirrup pump or garden hose, as a first line of defense. Dry sand is also provided, preferably in bags, for placing over the bomb to reduce scattering of sparks and emission of heat.

While water is by far the best weapon for use on bombs, there are several situations where sand will be useful: 1) if the bomb is where it cannot start a fire, sand may be dropped on it; 2) if no water is available, the bucket-and-shovel technique using sand may be used; and 3) if several bombs have fallen in one part of a building, those which cannot be tackled at once with water should, if possible, be covered with sand to prevent the sputtering of the bomb from setting fire to combustible materials and to keep the fire in check until the bombs can be dealt with.

Where the bomb rests on wood, it is important also to try to get a few inches of sand under it to help protect the wood from burning. But bombs so enclosed in sand are not extinguished and may burn through the floor, if it is not fire resistive, into the room below; consequently, they must never be left without further attention under such conditions.

Where possible, the bomb should be attacked from behind cover, such as a door, metal plate, chair, or other protection, remembering that the bomb may be one which will explode at any time within the first two minutes of ignition. Asbestos gloves and safety goggles provide additional protection. Buildings in the various territories, depending on their locations, size, and relative importance, have been equipped in the present emergency with various supplemental equipment, in addition to the usual fire-fighting apparatus. This includes such items as a fully equipped rolling fire truck for a building with elevators; or separate long-handle flat shovels, axes, pinch bars, jacks, helmets, etc., placed at strategic locations.

IT is not planned to use the regular complement of fire extinguishers in the handling of bombs, except in case of emergency where the supplemental stirrup pumps or hoses may not be adequate. The regular apparatus is held in reserve as far as possible for application on fires involving central office equipment, as provided in the Bell System normal fire protection practices. As a matter of fact, the carbon dioxide extinguisher is not effective on a magnesium bomb, but it can be effectively used on equipment fires started by the bomb. Soda-acid, water, and foam types of extinguishers can, in an emergency, be used with the thumb held over the nozzle. But even in the case of the water and soda-acid types, two or three extinguishers would be required to dispose of a bomb if the spray method were used.

Other Telephone Rooms

FOR spaces not involving combustible contents or intricate apparatus, the newer instructions to the public

TEST MOBILIZATION

Air raid fire and rescue squads assembled in the control room of a Bell System building after the "all clear"

recognize the advantages of shooting a jet of water directly at the bomb without delay, to put it out of action and leave the fire fighter free to deal with other bombs and fires. This procedure would be applicable, for example, to bombs falling on the roof or other open spaces and particularly on wood floors; but, as previously indicated, it would not be desirable in a telephone switchroom or operating room as compared with covering the bombs with sand and applying the spray of water.

The advantages of the jet or solid stream, as based on the most successful air raid defense abroad and on U. S. tests, rest on the desirability of speed and the use of less total water as compared with the spray treatment. Moreover, the fire fighter can stand farther away from the bomb when using a jet than he can when using the spray, and the directional force of the jet scatters the metallic fragments away from him. When the jet of water hits the bomb, there is a momentary flash of light and flame and a scattering of molten metal. An instant later, however, nothing is left but scattered fragments and the unburnable part of the bomb. These fragments, together with the fires which may have been started, are then quickly extinguished by the jet. The scattering of the bomb may also forestall the action of an explosive capsule, should there be one attached to the bomb.

As other evidence of evolution, the Russians are said to have extinguished incendiaries by throwing the bombs into barrels of water. The success of

TWO KINDS OF PROTECTIVE EQUIPMENT

Left: "Normal"—racked hose at standpipe, carbon dioxide extinguisher, asbestos gloves, alarm box. Below: Fixed emergency unit with sand, stirrup pump and pails, shovel, flashlights, goggles in box on rack, all for use against incendiary bombs

this method depends on complete "drowning" of the bomb. Also, we have read of the bravery of the British in flinging incendiary bombs from the roof of Canterbury Cathedral as fast as they were dropped from Nazi bombers. These comprise the acts of heroism outside the rules in the book as so far written, but emphasize again the courage of our allied defenders.

Other Types of Fire Bombs

IT may be interesting to note some other types of fire bombs. These have seldom been used, however, for various reasons, such as their less intensive heat or greater weight. There is the so-called thermite bomb, with its thermite encased in a thin steel shell; and the oil, the phosphorus, and the sodium and sodium-potassium alloy bombs, the make-up of which can be judged from their names.

The thermite bomb is handled in the same general manner as the magnesium bomb, while the oil bomb should be fought as any other flammable liquid fire, with foam or carbon dioxide extinguishers. The phosphorus bomb is easily extinguished with water or wet sand but re-ignites on drying. After a phosphorus fire has been extinguished, it is therefore necessary to keep all contaminated material wet until it can be carefully removed. This removal should be effected with great care because phosphorus is poisonous and will burn the skin. The sodium-type bombs can easily be extinguished by dry sand.

It's just as well to keep these other decoy bombs in mind and be prepared for enemy tricks of mixing up the types. But trickiness is not a monopoly of the living enemy. Blazing fire can always be counted on as a treacherous traitor, striking from seeming nowhere—at any time—in war or in peace.

Year-'round Fire Protection

LET us go back for a moment, then, to the solid foundation of peace-time fire prevention and fire control, and consider the means whereby the Bell System safeguards the reliability of telephone service by protecting its personnel, buildings, and equipment against fire.

Protecting the service against interruption from this cause includes not just fighting fires effectively but also the more necessary fundamental effort to prevent fires from starting in the first place. Many of the oldest telephone buildings were of what was considered fire resistive construction and, with these as a start, the record of the Bell System has been one of continuous and aggressive progress in the direction of more and better fire protection as the science advanced. These changes and developments over the years have made it necessary not only to keep abreast of the latest practices for incorporation into new buildings, but also to review existing structures in the light of applying these improvements to them. This is especially so in the case of quarters in leased buildings, of which there are a considerable number, generally involving the smaller telephone equipment installations.

Environment

ALL of this effort has involved the full and continued coöperation be-

tween staff members of the A. T. and T. Company and of the Associated Companies, together with advice from authorities outside the Bell System. The recommended practices of the National Fire Protection Association, the recognized source of information on the subject of fire protection, form the general basis of procedure, along with the standards of the National Board of Fire Underwriters, and State and Municipal regulations. Underwriters' Laboratories, Inc., test and list fire prevention and protection equipment, such as metal windows and doors, oil burners, and fire extinguishers. In addition to regular Bell System fire prevention activities, annual inspections of buildings are made by an independent firm of fire and safety experts retained to furnish advisory and inspection services. Their engineers also advise in regard to plans and specifications for new buildings and alterations and additions; and before any major work is contracted for, they review the project to determine the adequacy of fire protection features.

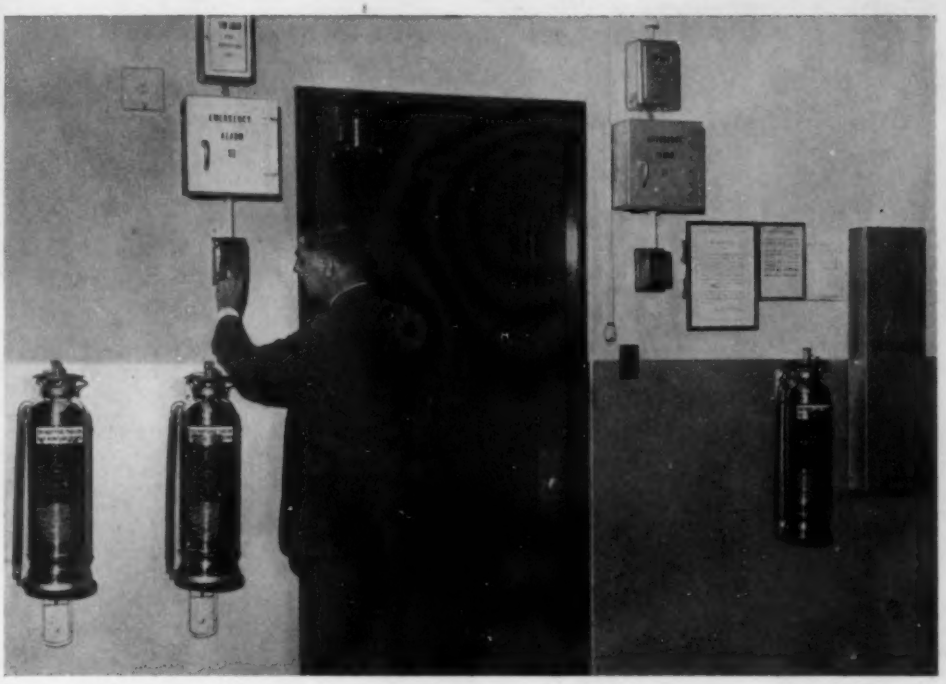
In the first place, over and above the many other considerations involved in establishing a location for a new telephone office, the selection of the site is influenced by the degree of exposure to fire from the surroundings. Adequate land to locate the building to the best advantage, and a corner lot where feasible, affording an extra street separation between buildings, contribute toward fire protection. The type of buildings and the character of occupancy in the neighborhood also have an important bearing on the selection of the office location.

Protective Armor

AFTER selecting the site and determining the location of the building on the lot, the aim to prevent damage by fire is maintained in carrying out the detailed plans. Efforts are directed to keeping fire out of the building and likewise to preventing fire from starting inside, or spreading if it does get started; also, to put it out in any event. In the layout of the floor plans, the telephone equipment arrangements are conceived to reduce risk of fire as far as possible. The equipment and cabling, for example, are arranged in an orderly way to reduce concentrations at any one point. The layout is further planned to permit ready access for fire fighting purposes.

Fire cut-off walls are provided and all openings and shafts for cables between floors are protected. The more important company-owned central office buildings are of fire-resistive construction; that is, they have masonry and fire-proofed steelwork, non-combustible floors, metal doors and metal windows with wired glass. Where the exposure is severe and a fire in an adjacent structure might be too great for the wired glass to resist the heat, fire shutters over the windows, designed to close automatically, are provided as additional protection. These are frequently built into the masonry for concealment from view.

In contrast, protection in some cases has been provided by installing open sprinklers, or water curtains, over the exterior of windows where practical difficulties and the cost of replacing ordinary windows with metal and wired glass were considered to be



MORE "NORMAL" FIRE FIGHTING EQUIPMENT
Water type extinguishers and, in the cabinet at the right, tarpaulins to cover equipment. The alarm boxes designate different locations

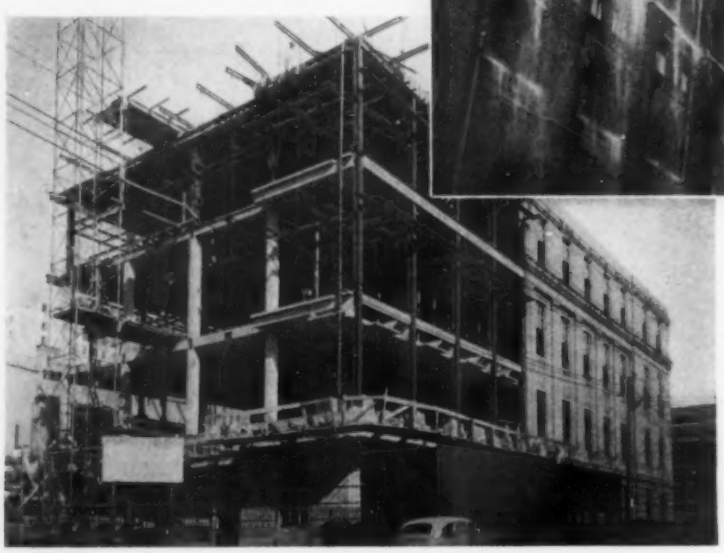
prohibitive. Such piping, exposed as it is outdoors, is normally free of water to prevent freezing. In case of fire in adjacent buildings, the water is turned on as shown on page 188. This protection is considered quite effective where provision has been made for reliability of water supply, which sometimes involves installing pumps and water storage tanks.

The very small owned offices, which would be comparable to those housed in leased quarters, usually have walls of some fire-resistive material. They are safeguarded from adjacent fires by locating them on sites sufficiently large to provide suitable clearances, or are protected on the exterior in much the same manner as the larger ones.

While the risk of a serious fire starting inside the telephone building is considered rather slight as compared with the possibility of a fire from sources external to the building, extensive measures are nevertheless taken to equip the building with fire-fighting apparatus and to provide safe exits in the form of fire-proof stairways, fire towers, or fire escapes.

Fighting Arms

IN selecting fire-protective appliances for use in telephone equipment spaces, their suitability is determined not only by the effectiveness in extinguishing fires, and approval of Underwriters' Laboratories, Inc., but also from the standpoint of causing the



Protection Against Fire in Neighboring Structures

Above: This central-office building, standing on an ample corner plot, has no close neighbors

Right: Test of water curtain used on a telephone building as protection should a bad fire occur in the adjacent building at the right in this picture

Below: Structural steel, reinforced concrete, and brick are used for an addition to this telephone building

least damage to the telephone equipment. The fact that the usual telephone building is occupied twenty-four hours every day in the year provides supervision for the discovery of a fire in its incipiency and offers a valuable first line of defense.

IT is, moreover, a fundamental objective of the Bell Telephone Laboratories in the development and design of telephone equipment, and of the Western Electric Company in its manufacture and installation, that every reasonable safeguard be taken to prevent the start or spread of fire in the telephone plant. Provision is made to limit the flow of current under trouble conditions and to design the wire and apparatus so that they will safely withstand the maximum temperature to which they may be subjected. Flammable materials such as shellac and insulating wax are avoided or carefully restricted. Likewise, great care is taken in the selection and treatment of materials to minimize the possibility of insulation breakdowns and fraying, for example, at the points of termination on the apparatus. An outstanding example in this direction is the development of washed textile and cellulose acetate insulation on the wires used in switchboards, frames, racks and elsewhere.

Another Bell Laboratories contribution is a fire-detection system, consisting of a continuous cotton-braid covered solder wire with flux core run through the telephone equipment at strategic locations. This fire detection system automatically sounds an alarm and identifies the location if an incipient blaze occurs in the wiring of the equipment—fortunately seldom experienced. Provision is also made in the circuit for manually sounding an alarm from conveniently located pull-boxes in case of any emergency.

The carbon dioxide extinguisher provides a medium whereby the blaze can be immediately extinguished by smothering without wetting the equipment or depositing harmful salts on it. Because carbon dioxide is so nearly ideal for extinguishing fires in electrical equipment, the Bell System has made contributions to its present-day effectiveness and was among the first to use this type in its plant. This extinguisher, of which there are two sizes, contains 7½ or 10 pounds of carbon dioxide gas under pressure which, in its operation, discharges a jet of gas for a period of some ¾ of a minute.

AS a secondary means of fighting the fire in the event that its scope is beyond the effectiveness of the carbon dioxide extinguisher, portable 2½ gallon water-type extinguishers are provided in strategic locations. This extinguisher, with its greater range of discharge and quenching and cooling action, would be used on a fire if it has made substantial headway. This type has a cartridge of gas which when punctured in its operation furnishes the pressure for expelling the water. The plain water used as the extinguishing agent has, of course, the disadvantage of wetting the telephone equipment, but this nevertheless is considered next best to the carbon dioxide.

The next resort would be to use the fire hose attached at each story to one or more standpipes, which are usually installed as part of the mechanical

equipment of the buildings. The standpipe and hose equipment is intended for use on interior fires only in the event they should reach such proportions that they could not be successfully handled with fire extinguishers.

In the higher buildings, generally over two or three stories, hose stations are also provided on the roof for use in protecting against adjacent fires menacing the telephone building. The regular water supply is used for the standpipe and hose system except where the pressure may be inadequate. In such cases, water is supplied by gravity tank or fire pumps. Arrangements are generally made for connection of Fire Department equipment at street grade.

SODA-ACID extinguishers, which some years ago were superseded for telephone equipment spaces by the water type extinguishers, are now generally used only in such areas as operators' quarters, office and clerical space, and storerooms. The operation of this more commonly known extinguisher depends on gas formed by the mixing of soda and acid to expel the water. But the disadvantage of this is that the water carries the resulting salts along with it, and this makes it unsuited for use on fires in telephone apparatus.

The foam type extinguisher, as an alternative to carbon dioxide, is used in kitchens, garages, paint rooms, and near oil burners. The foam type extinguisher, as indicated from the foregoing, is used on fires involving flammable liquids such as oil and grease. This extinguisher in outward appearance is similar to the water and soda-acid types, but does not have the tendency to spread the burning oil which the latter have. When the special chemical charges are mixed by inverting this extinguisher, the resulting reaction produces foam and also generates a pressure which forces the foam out of the hose. The principle of this type of extinguisher is the application to the fire of a smothering blanket of foam containing bubbles of carbon dioxide. In the Bell System they are normally not used on fires other than burning liquids and grease because of the damage caused to equipment by the foam which is rather difficult to remove.

For special cases where combustible contents indicate the need, such as basements containing supplies, or for warehouses and garages, automatic water sprinklers are used as supplementary protection. These are not provided in telephone equipment areas, since the other protection described is considered to be adequate.

Asbestos gloves for emergency use in extinguishing small fires in telephone equipment and for snuffing out small glowing embers after the flames have been smothered by the carbon dioxide, are furnished as well as portable tarpaulins for protecting telephone equipment against water damage.

Instruction and Inspection

UNDERLYING all these provisions is the practice of training the personnel in the use of the apparatus and procedures which includes, as a safety first measure, calling the municipal fire department immediately after discovery of a fire. Also, regular inspections, tests and maintenance of the

apparatus in accordance with established practices are basic essential requirements. Fire drills are conducted periodically with the purpose of familiarizing the occupants with the exits, which are all plainly indicated and illuminated where necessary.

Cleanliness and orderliness are indispensable factors in the elimination of fire hazards and, aside from the efforts of the fire protection engineers to provide the physical means to this end, these virtues must be largely relied upon to attain the desired results. In telephone buildings continuous stress is laid on the quality of housekeeping, providing a proper place for everything and keeping it there. And particular pains are taken to keep the spaces clean, and closets and attics clear of combustible storage. This routine, born out of practiced habit, adds no small part to the System's justified feeling of confidence when it comes to safety and control against fire.

IT may happily be that none of the war fire hazards discussed earlier in these pages will turn out here to be real; but even so, it is hoped that the national interest and coöperation in fire protection work will continue after the crisis is over. There is plenty of urge for this without the fires of war. No better support need be offered than the dismal record of the country's fire losses, a large proportion resulting from endless repetition of simple, everyday acts of carelessness and thoughtlessness. The enormous fire losses in the United States compare unfavorably with the relatively small losses in European countries, notwithstanding the much larger normal complement of fire department personnel and equipment here. In this country, emphasis has been placed on facilities for extinguishing fires, while Europe has depended for protection more on personal habits of carefulness and on establishing, in each case, legal responsibility for their violation. On the other hand, in America there is greater industrial concentration in large units and more extensive use of combustible construction, especially in congested residential areas. It is in these homes and other small-unit properties that the major part of the loss of life and injury by fire occurs. It is in the saving of such life and property that much is still desired and hoped for in preaching the gospel of carefulness in relation to "playing with fire."

Victory over fire would be in the making if the present interest in this all-important effort could be maintained in the battle to free America from the stigma of being the world's worst reveler in fire waste.

TELEPHONE STATISTICS OF THE WORLD

This Annual Survey of Telephone Facilities Everywhere, Although Necessarily Estimated in Large Part, Again Affirms This Country's Leadership in Voice Communication

By KNUD FICK

UNITED STATES OF AMERICA *Average telephone development, on January 1, 1941 in:*	*Number of Telephones per 100 Pop.*
6 cities with more than 1,000,000 population	25.10
13 cities with 500,000 to 1,000,000 population	26.30
31 cities with 200,000 to 500,000 population	24.51
150 cities with 50,000 to 200,000 population	20.93
All communities with less than 50,000 population	11.87

THE foregoing tabulation illustrates the penetration of telephone service into every type of community in this country, and shows the extent to which—in contrast to most foreign countries—the service is available not only in metropolitan centers but also throughout less densely populated areas.

Thus the smaller towns and rural communities, each with less than 50,000 inhabitants, had on the average more than one telephone for every ten people—men, women and children. It is only when comparison is made with conditions in other countries that it is realized how extraordinary is such uniform availability of telephone service. In fact, this development of the smaller communities in the United States is equaled in only a few of the world's largest cities outside the United States.

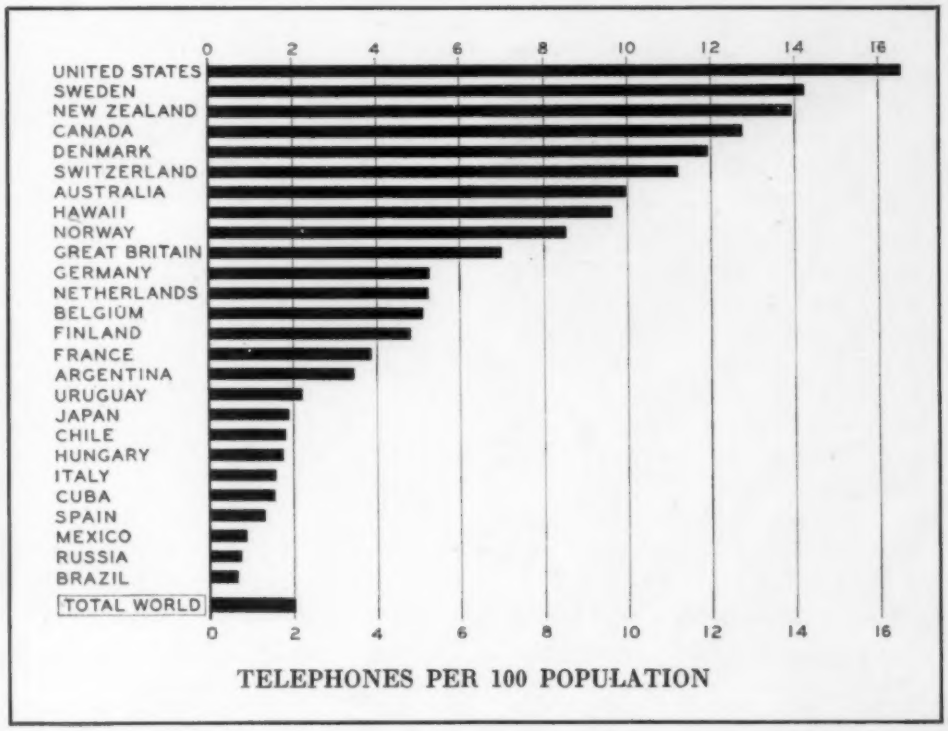
These and other data have been compiled by the Chief Statistician's Division of the American Telephone and Telegraph Company in connection with its annual survey of the world's telephone facilities. Similar bulletins—the only compilation based upon a canvass of every telephone system in the world—have been published each year since 1912, interrupted only by the years of World War I. Issued as a pamphlet entitled "Telephone Statistics of the World," this year's compilation was gathered in the face of increasing difficulties, because of the lack of statistical information for many of the foreign countries involved in the global war, and is restricted to the latest avail-

able telephone statistics for the major countries of the world, as well as estimated totals for each continent and for the world as a whole, as of January 1, 1941. Estimates have been based on previous years' figures and on such additional information as has been available.

For this MAGAZINE, a table has been prepared showing telephone data for countries in the Western Hemisphere, for which more detailed data were available, and also a table of telephone data for certain cities.

At the beginning of 1941, the total number of telephones in the world as a whole was estimated at 44,189,669. Of these, virtually one-half—or 21,928,182—were in the United States and nearly one-third—or some 15,900,000—in Europe. The remaining one-sixth of the world's telephones was located in other countries in the Western Hemisphere and in the continents of Asia, Africa and Oceania. The United States, however, has only 6 per cent of the world's population of slightly over two billion people, and thus enjoys a vastly greater telephone density in relation to population than the rest of the world: 16.56 telephones for every 100 inhabitants of the United States, compared to 2.75 in Europe and an average of only 1.08 for the world outside the United States.

The indicated net gain in telephones throughout the world during the year 1940 was a little more than one and a half million telephones, or at the rate of 3.6 per cent, compared to 3.8 per cent during 1939 and 4.7 per cent dur-



TELEPHONE DEVELOPMENT OF THE WESTERN HEMISPHERE
AS OF JANUARY 1, 1941

(PARTLY ESTIMATED)

Countries	Number of Telephones: Government Systems	Private Companies	Total	Per 100 Pop.	% Dial of Total Telephones
NORTH AMERICA:					
United States	—	21,928,182	21,928,182	16.56	53.36%
Alaska	—	6,152	6,152	8.31	0.00%
Canada	222,580	1,238,458	1,461,038	12.78	52.50%
Central America—					
British Honduras	460	—	460	0.78	0.00%
Costa Rica	170	5,533	5,703	0.88	0.00%
Guatemala	2,835	826	3,661	0.12	58.18%
Honduras (June 30, 1941)	1,973	2,879	4,852	0.43	24.42%
Nicaragua	1,679	121	1,800	0.13	12.78%
Panama (incl. C. Z.)	3,721	11,001	14,722	2.18	27.17%
Salvador	4,411	—	4,411	0.25	0.00%
Mexico	3,000	175,726	178,726	0.89	67.64%
Newfoundland	—	14,300	14,300	4.70	0.00%
West Indies—					
Bahamas	1,914	—	1,914	2.95	100.00%
Barbados	—	2,446	2,446	1.29	93.95%
Bermuda	—	2,350	2,350	7.58	100.00%
Cuba	891	67,592	68,483	1.57	79.83%
Curaçao & Aruba	1,600	—	1,600	1.48	68.75%
Dominican Republic	160	3,103	3,263	0.19	63.53%
Guadeloupe	400	—	400	0.12	0.00%
Haiti (Sept. 30, 1940)	2,700	—	2,700	0.08	74.00%
Jamaica	508	6,105	6,613	0.54	88.66%
Leeward Islands	681	—	681	0.47	0.00%
Martinique	1,500	—	1,500	0.60	0.00%
Puerto Rico	531	17,456	17,987	0.95	0.00%
Trinidad (& Tobago)	73	7,164	7,237	1.52	26.96%
Virgin Islands	572	—	572	2.29	0.00%
Windward Islands	1,356	—	1,356	0.60	0.00%
Other Places in No. America	100	—	100	0.56	0.00%
TOTAL NORTH AMERICA	253,815	23,489,394	23,743,209	12.66	53.36%
SOUTH AMERICA:					
Argentina	—	460,857	460,857	3.46	72.01%
Bolivia	—	2,621	2,621	0.08	23.96%
Brazil	1,291	289,619	290,910	0.65	73.91%
Chile	—	90,943	90,943	1.81	66.62%
Colombia	9,000	33,233	42,233	0.46	23.68%
Ecuador	4,200	3,400	7,600	0.26	0.66%
Guianas—					
British	2,528	—	2,528	0.73	6.77%
French	170	—	170	0.46	0.00%
Netherlands	700	—	700	0.39	0.00%
Paraguay	—	3,800	3,800	0.39	87.10%
Peru	—	35,151	35,151	0.52	73.54%
Uruguay (Jan. 1, 1939)	34,810	11,846	46,656	2.20	71.69%
Venezuela	760	31,096	31,856	0.88	86.48%
TOTAL SOUTH AMERICA (Estimated as of Jan. 1, 1941)	60,000	965,000	1,025,000	1.11	70.00%
TOTAL WESTERN HEMISPHERE	313,815	24,454,394	24,768,209	8.86	54.00%

ing 1938. Similar net gains for the United States were at the rate of 5.3 per cent during 1940, 4.4 per cent during 1939, and 2.6 per cent during 1938.

Close to 58 per cent of the total number of telephones in the world are connected to dial central offices. Nearly one-half of these dial telephones are in the United States.

The table on page 194, which was not included in the published bulletin, gives telephone statistics for individual countries in the Western Hemisphere, and cover a total of 24,768,209 telephones as of January 1, 1941, or 8.86 telephones per 100 population. With less than 13 per cent of the world's population and less than 9 per cent of its area, the Western Hemisphere thus has more than 56 per cent of the world's telephone facilities.

Outside the United States, the highest telephone development in the Western Hemisphere is that in Canada, with 1,461,038 telephones—all but 15 per cent of which are under private ownership. Canadian telephone development was equivalent to 12.78 telephones per 100 population. Other fairly large systems are located in Argentina, Chile and Mexico. Smaller systems with relatively high telephone development are to be found in Alaska, Bermuda, and Newfoundland, with 8.31, 7.58 and 4.70 telephones per 100 population, respectively.

In other parts of the world, the largest telephone systems are found, in the order named, in Germany, Great Britain, France, Japan and Russia—ranging from more than 4.2 million to about a million and a quarter telephones. In proportion to population, however, the best developed telephone systems are the Scandinavian, Swiss, Australian, Hawaiian, and New Zealand systems, all of which have in the neighborhood of one telephone for every ten people.

The table on pp. 196–197, showing the telephone development of representative cities in the United States compared with that of a number of foreign cities for which data were available as of January 1, 1941, while not included in the published bulletin, is shown here because of the significant data it reveals.

The largest urban telephone systems, as was to be expected, are those of New York and Chicago, with 1,713,544 and 1,032,902 telephones, respectively, at the beginning of 1941. The relative telephone density in cities and towns of the United States is well ahead of foreign developments. Thus, San Francisco on January 1, 1941, had a development of no less than 45.63 telephones for every 100 inhabitants. The only large foreign city to approach this high degree of telephone saturation was Stockholm, Sweden, whose 190,203 telephones on January 1, 1941, were equivalent to 41.46 per cent of its population.

During the year 1940, a total of 32½ billion telephone messages were exchanged in the United States, corresponding to 246.4 telephone conversations annually for every person in the country. The estimated average for the rest of the world is about 16 conversations per capita.

TELEPHONE DEVELOPMENT OF CITIES, JANUARY 1, 1941

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones Per 100 Population
ARGENTINA:			
Buenos Aires	3,450,000	290,955	8.43
Rosario	1,560,000	27,977	5.00
AUSTRALIA:			
Sydney	1,311,000	177,446	13.54
Melbourne	1,077,000	152,243	14.14
Brisbane	336,000	39,893	11.87
Adelaide	334,000	39,825	11.92
BAHAMAS:			
Nassau	20,000	1,914	9.57
BARBADOS:			
Bridgetown	71,000	2,057	2.90
BERMUDA:			
Hamilton	3,000	1,650	55.00
BOLIVIA:			
La Paz	200,000	1,218	0.61
BRAZIL:			
Rio de Janeiro	1,980,000	112,705	5.69
São Paulo	1,290,000	54,153	4.20
Bahia	400,000	6,734	1.68
BRITISH HONDURAS:			
Belize	23,000	337	1.47
CANADA:			
Montreal	1,105,000	192,540	17.42
Toronto	814,800	223,920	27.48
Winnipeg	305,000	52,275	17.14
Vancouver	295,000	80,469	27.28
Ottawa	225,000	44,679	19.86
Quebec	193,200	27,956	14.47
Hamilton	162,800	30,789	18.91
Windsor	118,500	17,585	14.84
Calgary	102,000	19,899	19.51
CHILE:			
Santiago	944,000	48,771	5.17
Valparaiso	216,000	8,322	3.85
Concepción	92,000	2,793	3.04
COLOMBIA:			
Bogotá	400,000	15,262	3.82
Barranquilla	247,000	4,361	1.77
PARAGUAY:			
Asunción	110,000	3,277	2.98
PERU:			
Lima	525,000	24,119	4.59
Callao	82,000	1,855	2.26
PHILIPPINE ISLANDS:			
Manila	790,000	26,881	3.40
Cebu	200,000	1,498	0.75
Iloilo	117,000	1,602	1.37
PORTUGAL:			
Lisbon	711,000	35,562	5.00
Oporto	288,000	12,233	4.25
PUERTO RICO:			
San Juan	175,000	10,376	5.93
Ponce	66,000	1,573	2.38
SPAIN:			
Barcelona	1,000,000	54,509	5.45
Madrid	953,000	70,398	7.39
Valencia	282,000	12,951	4.59
Sevilla	194,000	11,055	5.70
Bilbao	159,000	11,878	7.47
Málaga	152,000	4,289	2.82
Zaragoza	134,000	7,372	5.50
Granada	113,000	2,459	2.18
Cartagena	102,000	916	0.90
SWEDEN:			
Stockholm City	459,000	190,203	41.46
Göteborg	281,000	65,432	23.26
Malmö	155,000	30,975	19.92
Norrköping	71,000	12,691	17.92
Hälsingborg	62,000	10,925	17.53
SWITZERLAND:			
Zurich	330,000	75,633	22.92
Basel	167,000	39,867	23.87
Geneva	130,000	30,124	23.17
Bern	127,000	33,524	26.40
Lausanne	85,000	19,515	22.96

Barranquilla	247,000	4,361	1.77
Lausanne	85,000	19,515	22.96
COSTA RICA:			
San José	70,000	3,442	4.92
CUBA:			
Havana	701,000	48,639	6.94
Santiago	108,000	1,741	1.61
DOMINICAN REPUBLIC:			
Ciudad Trujillo	80,000	1,394	1.74
ECUADOR:			
Guayaquil	160,000	2,800	1.75
Quito	150,000	3,340	2.23
EIRE: (3/31/41)			
Dublin	492,000	26,367	5.36
Cork	81,000	3,565	4.40
GUATEMALA:			
Quatemala City	180,000	2,130	1.18
GUIANA (BRITISH):			
Georgetown	70,000	2,117	3.02
HAWAII:			
Honolulu	180,000	28,893	16.05
HONDURAS: (6/30/41)			
Tegucigalpa	48,000	1,084	2.26
HAITI: (9/30/40)			
Port-au-Prince	115,000	1,976	1.72
JAMAICA:			
Kingston	148,000	3,575	2.42
MEXICO:			
Mexico City	1,465,000	97,839	6.68
Guadalajara	228,000	8,895	3.90
Monterey	181,000	10,306	5.69
Pueblo	137,000	5,928	4.33
NEWFOUNDLAND:			
St. John's	59,000	7,669	13.00
NEW ZEALAND: (3/31/41)			
Auckland	215,000	34,640	16.11
Wellington	158,000	34,133	21.60
Christchurch	136,000	18,930	13.92
NICARAGUA:			
Managua	120,000	890	0.74
PANAMA:			
Panama City	113,000	5,210	4.61
Colón	46,000	1,241	2.70
TRINIDAD:			
Port-of-Spain	92,000	4,606	5.01
UNION OF SOUTH AFRICA: (3/31/41)			
Johannesburg	607,000	63,881	10.52
Cape Town	386,000	35,740	9.26
Durban	284,000	21,886	7.71
Pretoria	147,000	16,109	10.96
Port Elizabeth	130,000	7,599	5.85
VENEZUELA:			
Caracas	315,000	23,042	7.32
Maracaibo	125,000	2,460	1.97
UNITED STATES: (See Note)			
New York	7,492,500	1,713,544	22.87
Chicago	3,410,000	1,032,902	30.29
Los Angeles	1,485,000	477,032	32.12
Cleveland	1,159,100	284,429	24.54
Total 6 Exchange Areas with over 1,000,000 Population	17,380,600	4,361,989	25.10
Milwaukee	756,700	170,606	22.55
Boston	713,800	196,191	27.49
Washington, D. C.	700,000	275,326	39.33
San Francisco	649,200	296,226	45.63
Minneapolis	546,500	165,006	30.19
Total 13 Exchange Areas with 500,000 to 1,000,000 Population	9,013,700	2,370,884	26.30
Seattle	427,200	137,526	32.19
Denver	325,000	112,256	34.54
Omaha	248,100	70,749	28.52
Hartford	244,400	71,820	29.39
Total 31 Exchange Areas with 200,000 to 500,000 Population	9,815,000	2,405,687	24.51
Total 150 Exchange Areas with 50,000 to 200,000 Population	15,171,800	3,175,168	20.93
Communities with more than 50,000 Population	51,381,100	12,313,728	23.97
Communities with less than 50,000 Population	81,018,900	9,614,272	11.87

NOTE: There are shown, for purposes of comparison with cities in other countries, the total development of all cities in the United States in certain population groups, and the development of certain representative cities within each of such groups.

TELEPHONE DEVELOPMENT OF THE WORLD, BY COUNTRIES

Countries	Date of Statistics	Number of Telephones: Government Systems	Number of Telephones: Private Companies	Number of Telephones: Total	Telephones per 100 Population
NORTH AMERICA:					
United States #	Jan. 1, 1941	—	21,928,182	21,928,182	16.56
Canada	"	222,580	1,238,458	1,461,038	12.78
Central America	"	15,249	20,360	35,609	0.41
Mexico	"	3,000*	175,726	178,726	0.89
West Indies—					
Cuba	"	891	67,592	68,483	1.57
Puerto Rico	"	531	17,456	17,987	0.95
Other Places in the West Indies	"	11,464	21,168	32,632	0.39
Other Places in North America	"	100	20,452	20,552	5.19
Total	"	253,815	23,489,394	23,743,209	12.66
SOUTH AMERICA:					
Argentina	Jan. 1, 1941	—	460,857	460,857	3.46
Bolivia	"	—	2,621	2,621	0.08
Brazil	"	1,291	289,619	290,910	0.65
Chile	"	—	90,943	90,943	1.81
Colombia	"	9,000*	33,233	42,233	0.46
Ecuador *	"	4,200	3,400	7,600	0.26
Paraguay	"	—	3,800	3,800	0.39
Peru	"	—	35,151	35,151	0.52
Uruguay	Jan. 1, 1939	34,810	11,846	46,656	2.20
Venezuela	Jan. 1, 1941	760	31,096	31,856	0.88
Other Places in South America	"	3,398	—	3,398	0.60
Total (Estimated as of Jan. 1, 1941)		60,000	965,000	1,025,000	1.11
EUROPE:					
Belgium	Jan. 1, 1940	428,752	—	428,752	5.11
Bulgaria	"	31,225	—	31,225	0.48
Denmark	"	17,813	441,944	459,757	11.95
Eire	Mar. 31, 1941	46,726	—	46,726	1.56
Finland	Jan. 1, 1940	8,837	177,736†	186,573	4.81
France	"	1,622,680	—	1,622,680	3.86
Germany (incl. Austria and Sudetenland)	June 30, 1939	4,226,504	—	4,226,504	5.28
Great Britain and No. Ireland	Mar. 31, 1941	3,348,000	—	3,348,000	7.00
Greece	Jan. 1, 1940	5,967	48,437	54,404	0.76

Hungary	Jan. 1, 1940	178,325	790	179,115	1.76
Italy	Jan. 1, 1941	—	685,815	685,815	1.58
Netherlands	Jan. 1, 1940	461,424	—	461,424	5.23
Norway	June 30, 1939	153,000*	97,000*	250,000	8.52
Portugal	Jan. 1, 1941	21,000*	54,803	75,803	0.98
Roumania	"	92,107	—	92,107	0.51
Russia ¶	Jan. 1, 1939	1,272,500	—	1,272,500	0.75
Spain	Jan. 1, 1941	—	336,448	336,448	1.31
Sweden	"	906,917	1,736	908,653	14.26
Switzerland	"	474,038	—	474,038	11.23
Yugoslavia	Jan. 1, 1940	72,000*	—	72,000	0.45
Other Places in Europe *	Jan. 1, 1941	550,000	130,000	680,000	1.20
Total (Estimated as of Jan. 1, 1941)		13,920,000	1,980,000	15,900,000	2.75
ASIA:					
British India	Mar. 31, 1939	31,878	51,500	83,378	0.02
China *	Jan. 1, 1941	40,000	120,000	160,000	0.04
Japan	Mar. 31, 1939	1,367,958	—	1,367,958	1.89
Other Places in Asia *	Jan. 1, 1941	220,000	108,000	328,000	0.16
Total (Estimated as of Jan. 1, 1941)		1,710,000	290,000	2,000,000	0.19
AFRICA:					
Egypt	Jan. 1, 1940	67,983	—	67,983	0.30
Union of South Africa	Mar. 31, 1941	232,885	—	232,885	2.21
Other Places in Africa *	Jan. 1, 1941	146,000	1,460	147,460	0.11
Total (Estimated as of Jan. 1, 1941)		450,000	1,460	451,460	0.27
OCEANIA:					
Australia	Jan. 1, 1941	704,868	—	704,868	9.97
Hawaii	"	—	41,568	41,568	9.64
Netherlands Indies	Jan. 1, 1940	48,321	4,492	52,813	0.08
New Zealand	Mar. 31, 1941	228,346	—	228,346	13.96
Philippine Islands	Jan. 1, 1941	2,504	31,419	33,923	0.20
Other Places in Oceania *	"	5,300	380	5,680	0.25
Total (Estimated as of Jan. 1, 1941)		992,000	78,000	1,070,000	1.06
TOTAL WORLD (Estimated as of Jan. 1, 1941)		17,385,815	26,803,854	44,189,669§	2.02

* Partly estimated. † January 1, 1939. # As of January 1, 1942, there were 23,521,000 telephones in the United States. ¶ U.S.S.R., including Siberia and Associated Republics.
§ Approximately 58% of the total number of telephones in the world are estimated to be automatic or "dial" telephones, including, on January 1, 1941, some 11,700,000 "dial" telephones in the United States.

FOR THE RECORD

IN THE ARMED SERVICES

OF the 175,000 male employees of the Bell System (including the Western Electric Company and the Bell Laboratories), more than 15,000 are in the nation's armed forces as this issue of the MAGAZINE goes to press. In the General Departments of the A. T. and T. Company, of the 783 male employees the following are in the military services:

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James E. Wright, Clerk, Comptroller's Dep't .....Private, U. S. Marine Corps
Raymond A. Yerks, Senior Clerk, Treasury Dep't .....Private, U. S. Army

W. H. HARRISON MADE BRIGADIER GENERAL

VICE PRESIDENT William H. Harrison of the A. T. and T. Company, whose most recent government service has been as director of the production division of the War Production Board, became Brigadier General Harrison on June 26, and since July 1 has been in charge of the production activities of the Services of Supply of the Army.

General Harrison was nominated for promotion to his present rank by President Roosevelt within less than a week after he had entered the Army as a colonel. His new assignment reflects the policy of shifting production functions of the WPB (as distinguished from the work of other branches) into the Army and Navy. This shift, according to "Telecommunications Reports," Washington newsletter, "has been viewed for some time by the government leadership in Washington as the logical step in the war machinery, since the day-by-day production work is now wholly a task to be followed up by the armed services and WPB is becoming more and more concerned with the problems of materials and labor supply."

CONTRIBUTORS TO THIS ISSUE

ENTERING the Bell System as restaurant supervisor in charge of employees' dining service in the Philadelphia division of the Bell Telephone Company of Pennsylvania in 1916, RAYMOND A. STEELMAN was transferred to the A. T. and T. Company Department of Operation and Engineering in 1922. In the traffic employment section there, his work includes such matters as the recruiting and selection of telephone operators and their introduction to the business; working conditions, health, safety, employee informational activities, and employee out-of-hour

courses. Since the war began, Mr. Steelman has been closely identified with traffic personnel problems springing from the nation's war efforts, notably those having to do with operation by the telephone companies of the private branch exchanges at Army establishments. He is the author of "The Development of Employees' Dining Service and Other Quarters," which was published in the BELL TELEPHONE QUARTERLY of October, 1936.

A 1937 graduate of Wesleyan University, ALVIN VON AUW stayed on there to take his M.A. degree in 1938. After a year of editorial work in the magazine field, he joined the Western Electric Company's Public Relations Department in 1939, where since the first of this year he has been Information Supervisor. He has contributed numerous articles to trade and general publications on such subjects as broadcasting, aviation radio, marine radio, public address systems, and sound motion pictures. During recent months he has been editing a picture supplement, *Telephone Arsenal*, to Western Electric's six employee newspapers, and has been active in the preparation of the company's motion pictures. In the MAGAZINE for August, 1941, appeared his "Western Electric: Telephone Arsenal."

STARTING as a clerk in the office of the division traffic engineer of the Pacific Telephone and Telegraph Company in San Francisco in 1912, MARK R. SULLIVAN held a number of posts in the traffic department, including those of division traffic supervisor, general toll supervisor, and general traffic supervisor, until in 1928 he was appointed general traffic manager of the Northern California and Nevada area of the Pacific Company. In 1934 he was made vice president and general manager of that area; in 1938 his duties became company-wide when he was made chief of staff of the operating vice president's organization; and a year later he was elected vice president in charge of operations of the Pacific Company. On December 1, 1941, he was elected a vice president of the American Telephone and Telegraph Company. During the leave of absence of William H. Harrison, now Brigadier General in charge of production activities of the Army's Service of Supply, Mr. Sullivan is in charge of the A. T. & T. Co. Department of Operation and Engineering.

SHELLS and guns are not new to IRVIN M. CUPITT, for he worked on these in a steel mill during his years in college. Immediately after being graduated from the University of Pennsylvania in 1912 as a Civil Engineer, he joined the engineering department of the Bell Telephone Company of Pennsylvania, where he worked on problems incident to the erection of central-office buildings, supervising the planning phases and also at times the actual construction work. In 1925 he was transferred to the Equipment and Building Engineer's group in the A. T. and T. Company, and since 1932 he has been the group head responsible for the consultation service to the Associated Companies with regard to building plans and equipment layout—which includes, of course, protection of buildings and equipment against fire.

BORN in Denmark, KNUD FICK was graduated in 1916 from Hellerup Gymnasium, near Copenhagen, with a degree corresponding to Bachelor of Arts, supplementing this two years later with the degree of Candidate of Philosophy from the University of Copenhagen. Following a number of years in the Foreign Office and other branches of the Danish Government, he joined the American Telephone and Telegraph Company in 1925. In the Chief Statistician's Division of the Comptroller's Department he has been in charge of statistics and economics relating to foreign telephone development. In 1932 he was sent to Madrid, Spain, and in 1938 to Cairo, Egypt, in connection with work for the International Telecommunication Conferences. The present is his eighth annual contribution to the MAGAZINE and its predecessor on this topic.